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ECONOMIC INFLUENCE OF CANADIAN AGRIBUSINESS:
A SYSTEMS APPROACH

BY

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The undersigned certify that they have read and recommend to the Faculty of Graduate Studies for acceptance a thesis entitled "Economic Influence of Canadian Agribusiness: A Systems Approach," submitted by Peter Lang Appleton in partial fulfilment of the requirements for the degree of Master of Science.

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ABSTRACT

Canadian agribusiness has evolved in an unplanned, uncontrolled, and uncoordinated way over many decades. Public and private policy makers must understand the multidimensional nature of the Canadian economy with its various systems in order to implement policies which will result in the healthy growth of the whole and all its parts.

This thesis examines the structure, performance, and economic influence of the overall Canadian agribusiness system by means of conventional national accounting procedures and the systems approach by means of input-output analysis. Whereas national accounting procedures analyze each sector separately and independently, input-output analyzes sectoral interaction within the context of the complete system, the Canadian economy.

Input-output analysis and national accounting procedures are neither synonymous in defining the agribusiness system nor in evaluating the importance of the system to the Canadian economy. However, both methods conclude that the agribusiness system plays a vital role in the health of the Canadian economy. The agribusiness system contributed 21 percent of total Canadian Gross Domestic Product in 1966 and over 41 percent of Gross Domestic Product contributed by goods producing sectors. The meat and poultry processing sector stands out as the most significant sector contributing to the growth and development of the agribusiness system and as such to the Canadian economy.

The systems approach leads to a comprehensive understanding of the total system and the various ramifications that occur within it as a result of changing conditions within any one sector. As such, it provides a framework for the development of Canadian national policies that will optimize economic and social goals.

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TABLE OF CONTENTS

Page

ABSTRACT iii

ACKNOWLEDGEMENTS iv

LIST OF TABLES vii

LIST OF FIGURES ix

CHAPTER

I INTRODUCTION 1

Objectives 2
Hypothesis 3
Methodology 3
Source of Data 4
Limits of Data 4
Development of the Thesis 4

II INPUT-OUTPUT ANALYSIS REVIEWED 6

Development of Input-Output Analysis 6
Canadian Research 9
Other Research 12

III THE NATURE OF AGRIBUSINESS 14

The Structure of Canadian Agribusiness 14
Business Results of Canadian Agribusiness 27

IV THEORETICAL STRUCTURE OF INPUT-OUTPUT ANALYSIS 36

Input-Output Accounting 36
Production Theory of Input-Output Analysis 39
Developing an Input-Output Model 46
Developing a Canadian Input-Output Model for 1966 49
Relation of the 1966 Canadian Input-Output Table to National Accounts 59

V AGRIBUSINESS IN THE CANADIAN ECONOMY 65

The Input-Output Structure of the Canadian Economy 65
Input-Output Definition of Agribusiness 74
Flow of Canadian Agribusiness Products 82
Sector and Aggregate Interrelationships 85

CHAPTER Page

VI DIRECT AND INDIRECT AGRIBUSINESS RELATIONSHIPS 96

Methodology 96
Evaluation of Canadian Agribusiness Relationships 98
Detailed Analysis of Selected Sectors 105

VII ECONOMIC INFLUENCE OF CANADIAN AGRIBUSINESS 115

Multiplier Analysis 115
Wages and Salaries Generated by Requirements for Products of Canadian Industry, 1966 121
Canadian Gross Domestic Product, 1966 126

VIII SUMMARY, CONCLUSIONS AND POLICY FRAMEWORK 130

Summary and Conclusions 130
Policy Recommendations 132
Research Recommendations 134

BIBLIOGRAPHY 135

APPENDIX A 142

APPENDIX B 145

APPENDIX C 155

APPENDIX D 160

APPENDIX E 165

APPENDIX F 169

APPENDIX G 172

APPENDIX H 182

APPENDIX I 185

APPENDIX J 189

LIST OF TABLES

Table Page

1. Canadian Balance of Payments, 1966 16

2. Personal Consumer Expenditure, Canada, 1966 and 1969 17

3. Industrial Labour Force, Canada, 1966 and 1969 19

4. Capital Investment, Canada, 1966 21

5. Total Investment in Capital and Labour, Canada, 1966 22

6. Concentration of Canadian Manufacturing Industries, 1964 25

7. Canadian Wholesale and Retail Trade Emphasizing Agribusiness, 1966 26

8. Industrial Balance Sheet Emphasizing Agribusiness, Canada, 1966 28

9. Agribusiness Income Statement, Canada, 1966 31

10. Percentage Canadian Ownership in Industry, 1966 34

11. Conciliation of Input-Output and National Accounts Gross Domestic Product at Factor Cost, 1966 63

12. Input-Output Characteristics of Canadian Industry, 1966 66

13. Total External Trade and as a Percentage of Total Output by Industrial Sector, 1966 72

14. Percentage Output to Final Demand by Industrial Sector, 1966 75

15. Percentage Input From and Output to Agriculture, and Food and Beverage Sectors, 1966 77

16. Classification of Sectors by Percent Input From or Output to Agriculture, Food and Beverages 80

17. Agribusiness Transactions 85

Table Page

18. Purchases From and Sales to the Food and Beverage Aggregate by the Farming Aggregate, 1966 91

19. Gross Output of Each Processing Sector Required in the Canadian Economy to Satisfy the Direct Purchases of Final Consumers From Each Sector, 1966 99

20. Major Industries that Procure Directly From Agriculture and Major Industries that Procure Directly from the Buyers of Agriculture, 1966 102

21. Direct and Indirect Requirements From Selected Industries per Million Dollars of Final Demand From the Major Direct and Indirect Buyers From Agriculture, 1966 104

22. Input-Output Structure of the Canadian Agriculture Industry, 1966 106

23. Input-Output Structure of the Canadian Meat and Poultry Processing Industry, 1966 109

24. Input-Output Structure of the Canadian Fertilizer Industry, 1966 113

25. Ranking of Top 20 Goods and Services Producing Sector Multipliers in Descending Order 118

26. Wages and Salaries Generated by Requirements for Products of Canadian Goods and Services Producing Sectors, 1966 122

27. Input-Output Gross Domestic Product of Canadian Agribusiness, 1966 128

LIST OF FIGURES

Figure Page

1. Interindustry Accounting System 37

2. Long Run and Short Run Production Functions for Sector j 44

3. Schematic Accounting Framework of the 1966 Canadian Input-Output Table 51

4. Canadian Agribusiness Flow Chart, 1966 83

5. Purchase By and Sales of the Agriculture Aggregate, 1966 87

6. Purchases By and Sales of the Food and Beverage Aggregate, 1966 89

7. Purchases By and Sales of the Fiber Processing Aggregate, 1966 93

8. Purchases By and Sales of the Chemical Processing Aggregate, 1966 94

CHAPTER I

INTRODUCTION

> "The agricultural world and the industrial world are not two separate economies having merely a buyer-seller relationship. Rather, they are so intertwined and inseparably bound together, that one must think of them jointly if there is to be any sound thinking about either one or the other" [Hauser, 1955].

The Canadian economy is a multidimensional system of economic activity in which no economic unit acts as an independent system; rather units are intertwined to form a vast flow system of sectors dependent upon each other for their very existence. Agribusiness, as well as any other socio-economic group, interacts with this system to maintain economic, social, cultural, and political relationships with the rest of society.

When a segment such as Canadian agribusiness evolves in an unplanned, uncontrolled, and uncoordinated way over many decades, it is likely to develop problems and inefficiencies. The direction, nature, and rate of the change must be examined against a background of the structure, economic influence, strengths, and weaknesses of the overall agribusiness segment within the total system.

Economic and social goals for one or more sectors of the economy must be integrated with overall economic and social goals. Goals must be specified by sector, but with consideration for those designated for the whole economy.

The Economic Council of Canada in its First Annual Review [Economic Council of Canada, 1964] outlined the following basic social and economic goals for the Canadian economy to 1970:

1. No more than 3 percent unemployment;
2. A rate of economic growth in excess of 5.5 percent;
3. A reasonable stability of prices;
4. A viable balance of payments;
5. An equitable distribution of income.

Judged in 1964 to be attainable given appropriate public and private policies, these goals have not been reached. Canadian government and industry have specified no such goals at the sectoral level. Present Canadian private and public policies for subsystems are not integrated with policies for the overall system.

Input-output analysis allows both private and public policy makers to view the Canadian economy as a set of subsystems intertwined to form one large system.[1] Using this analytical method, policy makers and economic analysts may determine the interrelationships of policy decisions. The overall effects, both direct and indirect, of policy changes may then be determined well in advance of implementation.

Objectives

The objectives involved at the outset of this study were:

1. To quantify and analyze the structure of the Canadian economy using an input-output table;

2. To define the agribusiness subsystem of Canada in terms of national accounts as well as input-output analysis;

3. To determine the importance of the agribusiness system

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[1] Churchman says that "systems are made up of sets of components that work together for the overall objective of the whole. The systems approach is simply a way of thinking about these total systems and their components" [Churchman, 1968, p. 11].

to the Canadian economy by means of conventional national accounting methods;

4. To determine the importance of the agribusiness system to the Canadian economy by means of input-output analysis, emphasizing intersectoral relationships;

5. To develop an approach which policy makers can use in developing economic and social policies for a subsystem with regard to economic goals of the system as a whole.

Hypothesis

It was hypothesized that:

Input-output analysis provides a better measure of sectoral interdependence and as such better estimates the economic influence of Canadian agribusiness than conventional accounting procedures.

Methodology

Two analytical techniques to measure the scope and magnitude of agribusiness and its component parts in Canada have been used. General accounting methods represent a conventional approach to measurement [Dominion Bureau of Statistics, National Accounts, Income and Expenditure, Annual].

The Leontief input-output technique represents an alternative method of measurement. A 1966[2] input-output table for the Canadian economy was developed. The channels of purchasing and selling of a 93-sector breakdown of the economy were established. Mathematical manipulation of this flow table enables an analysis of sectoral interaction.

---

[2] It was necessary to develop an input-output table for 1966 because only tables for 1948 and 1961 existed.

Sources of Data

The sources of information are published and unpublished figures released by the Dominion Bureau of Statistics, Canada Department of Industry, Trade and Commerce, Canada Department of Agriculture, Canada Department of Finance, the Agricultural Economics Research Council of Canada, and various other agricultural and business publications.

Limitations of Data

Primary limitations of this study were encountered in the collection of data for the input-output table. Much of the information required was not publicly available. Further limitations of the data are discussed in Chapter Four.

Development of the Thesis

This thesis is divided into eight chapters. Chapter Two presents a review of the development of input-output analysis as a tool in the systems approach. Works applying this approach to agribusiness policy making are discussed, with emphasis on Canadian-American applications. Chapter Three describes agribusiness in conventional terms; i.e., the structure and business results of agribusiness are analyzed using national accounting techniques. Chapter Four introduces an alternative method--input-output analysis--for measuring the same things that were measured in Chapter Three using national accounting techniques. Chapters Five and Six use input-output analysis to evaluate the interaction of the sectors of the Canadian economy emphasizing the agribusiness system. Chapter Seven presents a measure of the economic influence of Canadian agribusiness. Chapter Eight considers the need for developing agribusiness policy in light of the evidence presented here.

Neither conventional accounting procedures nor input-output analysis provide a comprehensive appraisal of industrial performance in the context of the Economic Council of Canada's goals. Consequently, this study sheds no light on performance goals with respect to stability of prices and income distribution. Further work in this area might overcome this limitation.

The validity of the input-output table developed for this thesis is limited not only by the assumptions of input-output analysis and the accuracy of available data but by the time and finance available to the researcher.

CHAPTER II

INPUT-OUTPUT ANALYSIS REVIEWED

One important development in the field of economics during this century is the model of industrial interdependence known as input-output analysis. The theory of input-output analysis has at least three important aspects:

1. The model provides the simplest expression of Walrasian general equilibrium conditions.[1] Its form is such that it allows empirical statistical measurement.

2. Input-output analysis provides a detailed breakdown of the macroaggregates and money flows.

When used to describe the Canadian economy, input-output analysis provides a statement of intra- as well as interindustry transactions. Interindustry transactions are ignored in conventional national accounts.

Development of Input-Output Analysis

The first step toward a form of general equilibrium analysis, from which the input-output method stems, is customarily attributed to

---

[1] Walras states his equilibrium conditions of production as:

1. a state in which the effective demand and offer of productive services are equal and there is a stationary current price in the market for these services;
2. a state in which the effective demand and supply of products are also equal and there is a stationary current price in the products market;
3. a state in which the selling prices of products equals the cost of the productive services that enter into them [Walras, 1954].

the French economist Francois Quesnay. In 1758 Quesnay published his Tableau Economique[2] in which the concept of compartmentalized productive activities was first advanced [Quesnay, 1758]. These ideas are said to have influenced Adam Smith in his work, The Wealth of Nations, published in 1776. However, the basic idea of a general equilibrium model was not again emphasized until Leon Walras published Elements D'Economie Politique Pure in 1874 [Walras, 1954]. In Part Two, which appeared in 1877, Walras developed his theory of production and established the interdependence of productive sectors of the economy. In an abstracted model Walras dealt with industrial demand for factors of production and the substitution of such factors in production. He formulated his system mathematically and developed a set of equations documenting sales to and purchases from productive sectors.

In 1925, in reviewing an outline of an interindustry table for the Soviet Union, Professor Wassily Leontief of Harvard University wrote in the Weltwirtschaftliches Archiv:

> This fundamentally new balance sheet, when compared to traditional work in the United States and Great Britain, is far superior. It not only explains production but also the distribution of the final product in a type of tableau economique [Leontief, October 1925].

It was not until the mid-1930's that Leontief developed the first applied model of this type based on empirical data available for the economy of the United States. Leontief began work on the construction of the first input-output table for the United States in 1931. He spent five years developing his tables and applying the mathematics.

---

[2] Quesnay's Tableau Economique presented productive industry (agriculture), service industries, and final demand in a form strongly suggestive of present-day input-output models.

His first study, published in The Review of Economic Statistics in August 1936, presented a 42-member input-output table that illustrated the quantitative input and output relations for the economic system of the United States in 1919. Leontief wrote, "The statistical study presented . . . may be best defined as an attempt to construct, on the basis of available data, a Tableau Economique of the United States for the year 1919" [Leontief, August 1936, p. 105].

Leontief published a more complete investigation of the subject in 1941 under the title The Structure of the American Economy, 1919-1939 [Leontief, 1941]. It included a 21-sector input-output table and laid the groundwork for the practical application of his theory. The model was static in that it displayed fixed input coefficients.

In 1944 the American Bureau of Labor Statistics applied Leontief's method to estimate the distribution of employment in December 1945, assuming that the war would end June 30, 1945. This was the first formal use of input-output analysis for prediction. After a series of analyses evaluating postwar development of the United States, the Department of Labor, the Council of Economic Advisors, the Economic Cooperation Committee and the Bureau of Labor Statistics in 1949 developed an input-output table of the United States for 1947 [Evans and Hoffenberg, May 2, 1952].

In 1951 a revised edition of The Structure of the American Economy appeared [Leontief, 1951]. It included a discussion on the advancement from a closed to an open system and on the influence of input-output analysis on decision making. Input-output analyses became part of the political economy.

Samuelson, Koopmans, and Arrow, in separate contributions to Activity Analysis of Production and Allocation [Koopmans, 1951], demonstrated the convenience of incorporating analysis of new possibilities of substitution in order to generalize the ordinary input-output model. Dantzig and Koopmans in the same volume developed the mathematical technique of activity analysis or linear programming. Their development allowed the relaxation of fixed input coefficients.

In 1952 the National Bureau of Economic Research held its eighteenth conference on the subject of Research in Income and Wealth, to discuss input-output analysis [National Bureau of Economic Research, 1955]. It proposed to generalize ordinary input-output theory by incorporating nonhomogeneous and nonlinear functions.

Chenery and Clark later formalized the theory of interdependence of economic units into "interindustry economics" [Chenery and Clark, 1959]. They presented a unified discussion of interindustry techniques and their empirical applications. Substantive conclusions about the structure and performance of an economy that can be derived using the interindustry approach, were emphasized.

Research in input-output economics has progressed rapidly since the 1930's, and the statistical analysis of interindustry relations has now been undertaken in more than thirty countries to complement more traditional economic studies.

Canadian Research

Of prime interest to the Canadian researcher is the 42-sector input-output study of Canada for the year 1949, which was completed in 1956 [Dominion Bureau of Statistics, 1956]. The theoretical development

of this first Canadian input-output table closely followed the construction of the first American table for 1947.

Unlike the 1949 model for Canada, the 1961 model [Dominion Bureau of Statistics, 1969] had features which were not characteristic of conventional input-output tables. Both the inputs and the outputs were classified in two ways: (a) according to the producing or using sector, and (b) according to the commodity produced or used. This resulted in the computation of a rectangular matrix of 187 industries and 644 commodities, as opposed to the conventional Leontief square matrix. Three aggregations of this detailed and comprehensive system were presented for the Canadian economy. The initial purpose was to improve the systems of national accounts and other government statistics. These studies were done solely to provide a detailed description of the economy, rather than as the basis for an econometric model.

In the 1960's Canadian governments directed attention to regional problems. The decade saw the development of input-output tables for eight provinces: Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick, Quebec, Ontario, Manitoba, and Alberta. In developing her model for the Maritime Provinces, Levitt emphasized the government sector in great detail [Levitt, June 6, 1969]. Such information allowed governments to predict the total direct and indirect economic impact of any proposed change in their taxation or expenditure policies. The Quebec table, prepared by Le Bureau de la Statistique du Quebec et Laboratoire d'econometrie de l'Universite Laval for the Quebec economy for 1961, was refined and detailed. Data were collected on a commodity classification basis, enabling a more precise calculation of the technical input coefficients. Although less detailed than the Quebec or

Maritime models and, hence, less useful in decision making, the Manitoba table, prepared by the Manitoba Economic Consultative Board in 1968 for the Manitoba economy in 1961, stimulated provincial policy makers to carry the work further.

The application of the input-output technique in analyzing the interdependence among sectors of the economy became apparent in Canada during the 1960's. Josling and Trant, in a study emphasizing the interdependence among agricultural and other sectors, developed a 34 x 36 flow table for the Canadian economy for 1958 [Josling and Trant, 1966]. They concluded that input-output coefficients for agricultural products would be useful in an investigation of production adjustment possibilities on a national or regional scale.

Yeh and Lin developed a model of the Canadian livestock industry utilizing input-output technique [Yeh and Lin, 1969]. They used their tables for 1951 and 1961 to quantify the interdependence among the livestock industry and other related industries and to develop multipliers within agriculture based on these interrelationships. Projections for meat products were made to 1975.

In 1968 the Federal Task Force on Agriculture commissioned a study to survey Canadian agribusiness [Patterson, 1969]. In comprehensively covering Canadian agribusiness, Patterson took the systems approach, using the Dominion Bureau of Statistics input-output table for 1961. This study, subsequently published in part in the final report of the Task Force [Task Force on Agriculture, 1969], has perhaps set a precedent for government thinking towards the systems approach to commodities and industries.

Other Research

The most comprehensive and relevant application of input-output technique to analysis of a system has been done by the Harvard School of Business. In the first North American application of input-output analysis to a system, Davis and Goldberg thoroughly defined and analyzed agribusiness in the United States [Davis and Goldberg, 1957]. They were aided by "The Interindustry Relations Study for 1957" [Evans and Hoffenberg, May 2, 1952]. The authors felt that their approach revealed "an extensive and comprehensive research system that is able to penetrate the agribusiness frontier in a systematic and orderly manner for the purpose of finding new answers to pressing problems" [Davis and Goldberg, 1957, p. 81]. The interrelated effects of agribusiness and other sectors of the economy were shown to be much greater than was anticipated. An aggregated effect by sectors upon the economy was not calculated; aggregate sector multipliers were not calculated or analyzed.

Goldberg in subsequent work [Goldberg, 1968] developed a schematic analysis of the everchanging structure and performance of a widely divergent group of commodity systems. He postulated that the success of an individual firm is dependent upon the economic health and efficient development of its commodity system. Using his analysis, managers are better equipped to develop creative strategies for their systems to ensure effective response to consumer needs.

Roy took a similar approach to Davis and Goldberg in simplifying the systems approach for a university textbook [Roy, 1967]. He analyzed agribusiness in its direct relationships to the economy, but failed to account for the often more numerous indirect relationships.

Since 1950 American economists have applied input-output techniques at the regional level. Walter Isard applied input-output analysis to the study of interregional relationships [Isard, 1951]. Using this technique he developed a model of space economy. In further work [Isard, 1953], he defined and analyzed some problems encountered in using the input-output technique in a regional model.

Isard principles of input-output technique were applied by Moore and Petersen in 1955, when they developed a regional model for Utah [Moore and Petersen, 1955]. Problems existed in the calculation of regional imports and exports.

Also in 1955 Petersen and Heady applied input-output techniques in an intersector analysis [Petersen and Heady, 1955]. Sector classification and data availability problems when dealing with a national economy limited the results of the study to crude estimates.

In 1957 Schnittker and Heady applied the same model to a region [Schnittker and Heady, 1957]. As in the Petersen and Heady study, agriculture was emphasized. Results were encouraging in that precise and applicable measures were attained.

Greater detail was attained by Martin and Carter in 1962 in applying interindustry analysis to California emphasizing agriculture [Martin and Carter, 1962]. The basic research involved formulating the model and evaluating the implications of the results. The authors paid special attention to implications involving employment, interregional trade, and resource allocation.

This chapter has reviewed major developments in the theory and use of input-output analysis. The following chapter takes the conventional approach to agribusiness; uses national accounting technique to define agribusiness and analyze the structure and performance of the system.

CHAPTER III

THE NATURE OF AGRIBUSINESS

Agribusiness in Canada means many things to many people. To develop agribusiness policies that will achieve optimum satisfaction for all sectors of the economy, it is essential that the dimensions of agribusiness be defined consensually. To understand the role and importance of agribusiness in the Canadian economy, agribusiness must be defined with respect to other aggregated sectors of the economy. Chapter Three proposes that a large aggregated system of the economy be broken down into the following categories: Agribusiness, Renewable Natural Resources, Nonrenewable Natural Resources, Personal Items, Public Items, Services and Trade, Government Activity, Corporate and Public Earning, and External Trade. These eight aggregated sectors are defined in Appendix D in terms of the input-output sectors aggregated for the present study, which in turn are defined in Appendix A according to the Standard Industrial Classification Manual [Dominion Bureau of Statistics, 1960].

Chapter Three presents the conventional approach to agribusiness. The input-output approach to sector definition developed in later chapters serves as a check on the conventional method.

The Structure of Canadian Agribusiness

To obtain a comprehensive picture of conventional agribusiness and its component parts, the main sectors of the economy must be considered in comparative statistical terms. Conventional business accounting techniques are used in calculating the magnitude of the six aggregated goods and services sectors (Appendix D).

The Canadian Balance of Payments

In 1966 Canada relied heavily on her natural resources for international trade. She achieved a positive balance of payments in only three of the eight aggregated sectors demonstrated in Table 1. These sectors were basic agriculture, recurring natural resources, and nonrecurring natural resources. Basic agriculture had a positive balance of payments of 1,267.8 million dollars, compared with public items which had a negative balance of 1,090.3 million dollars. The summation of all external trade by Canada in 1966 amounted to a positive 535.6 million dollars.

Agribusiness (excluding basic agriculture), with a negative balance of 466.0 million dollars, contributed 9.4 percent of exports and 14.2 percent of imports. Although re-exports data are available, there is little information on re-imports, or imports of goods and services previously exported by Canada. There is evidence that Canada exports large amounts of raw goods that are processed abroad for return sale to Canada. Table 1, indicating the pattern of Canadian trade, seems to suggest this. Raw food materials constitute a large proportion of Canadian exports; processed food products constitute a large proportion of Canadian imports.

Table 1 confirms the conclusion that greater emphasis should be given to agribusiness definition when determining the role of agriculture in foreign trade. There is also a need for the development of domestic agribusiness establishments in Canada.

Personal Consumer Expenditure

In 1966 Canadians spent 12,995 million dollars, or 36 percent,

Table 1

CANADIAN BALANCE OF PAYMENTS, 1966

($ million and as % of total)

1966	Basic Agriculture $	%	Agribusiness[1] $	%	Recurring Natural Resources $	%	Nonrecurring Natural Resources $	%	Personal Items $	%	Public Items $	%	Service and Trade $	%	Other $	%	Total $
Exports	1564.2	14.5	1016.3	9.4	245.7	2.3	1874.5	17.3	848.8	7.9	4433.5	41.0	58.2	0.5	767.9	7.1	10809.1
Re-exports	0.3	0.1	16.4	6.5	0.5	0.2	4.7	1.9	34.7	13.8	189.6	75.5	3.8	1.6	1.0	0.4	251.0
Imports	-296.7	2.8	-1498.7	14.2	-28.7	0.3	-856.9	8.1	-1017.6	9.7	-5713.4	54.3	-330.3	3.1	-782.2	7.5	-10524.5
Balance of Payment	+1267.8		-466.0		+217.5		+1022.3		-134.1		-1090.3		-268.3		-13.3		+535.6

[1] excluding basic agriculture

Sources: D.B.S., Exports by Commodities, Catalogue No. 65-004 (Ottawa: Queen's Printer, December 1966); D.B.S., Imports by Commodities, Catalogue No. 65-007 (Ottawa: Queen's Printer, December 1966).

Table 2

PERSONAL CONSUMER EXPENDITURE (P.C.E.), CANADA, 1966 AND 1969

	1966 - Population 20.01 Million			1969 - Population 21.26 Million		
Area of Expenditure	PCE ($ million)	Percent	Per Capita PCE	PCE ($ million)	Percent	Per Capita PCE
Food and nonalcoholic beverages	6,374	17.7	318.54	7,634	16.6	359.08
Alcoholic beverages	1,290	3.6	64.47	1,629	3.5	76.62
Tobacco products and accessories	935	2.6	46.73	1,086	2.4	51.08
Clothing and accessories	2,937	8.1	146.78	3,579	7.8	168.34
Pharmaceuticals	437	1.2	21.84	623	1.4	29.30
Total agribusiness products	12,995	36.0	649.43	15,670	34.1	737.05
Personal items	2,796	7.8	139.73	3,270	7.0	153.81
Public items	6,691	18.6	334.38	8,578	18.6	403.48
Services and trade	13,575	37.6	678.41	18,590	40.3	874.41
Totals	36,057	100.0	1,801.95	46,108	100.0	2,168.75

Sources: D.B.S., Canadian Statistical Review, Catalogue No. 11-003 (Ottawa: Queen's Printer, June 1970); D.B.S. Unpublished Statistics.

of their total expenditures on agribusiness products. By 1969 Canadians had increased total expenditures on agribusiness products to 15.7 billion dollars, while decreasing the proportion of total expenditures to 34.1 percent. Table 2 displays a decrease in expenditures on personal items from 7.8 percent to 7.0 percent of total expenditures. Public item expenditures remained constant at 18.6 percent of total expenditures. Personal consumer expenditure on services and trades showed a marked increase from 1966 to 1969, from 37.6 percent to 40.3 percent of total expenditures. The three-year period saw an increase in personal consumer expenditure of approximately 10 billion dollars.

Per capita expenditures for all goods and services showed a marked increase from 1966 to 1969. Total per capita expenditures increased from approximately 1,800 to 2,200 dollars.

Labour Force and Wages and Salaries

Another facet of the Canadian economy is revealed by examining the labour force and wages and salaries received by the various sectors of the economy. Table 3 presents the distribution of employment in 1966. Basic agriculture employed 551,000 people, the rest of agribusiness, 418,994. In the Canadian food and fiber industry, there were three workers off the farm for every four on the farm. Agriculture employment figures include all paid workers, self-employed, and unpaid family workers. In 1966, 23.2 percent of the labour force worked in the aggregated agribusiness sector.

Average wages and salaries paid by sector are also shown in Table 3. A weighted industrial composite average for the years 1966 to 1969 increased from approximately 99 to 117 dollars per week. In both years

Table 3

INDUSTRIAL LABOUR FORCE, CANADA, 1966 AND 1969

Area of Expenditure	1966 Employment		Weekly Wages and Salaries			
			1966		1969	
	No. of Employees	% of Total	$	% of Average	$	% of Average
Basic agriculture	551,000	13.2	49.75	50.0	58.90	50.3
Agribusiness[1]	418,994	10.0	93.57	94.1	101.45	86.6
Renewable natural resources	68,839	1.7	85.00	85.5	100.33	85.7
Nonrenewable natural resources	109,784	2.6	138.25	139.0	153.19	130.8
Personal items	388,143	9.3	90.47	91.0	109.55	93.6
Public items	854,837	20.5	115.82	116.4	140.01	119.6
Services and trade	1,781,089	42.7	93.10	93.6	112.44	96.0
Total employment and average industrial composite wages	4,173,686	100.0	99.46		117.09	

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[1] excluding basic agriculture

Sources: D.B.S., *Review of Employment and Payrolls*, Catalogue No. 72-201 (Ottawa: Queen's Printer, 1962); D.B.S., *Employment and Average Weekly Wages and Salaries*, Catalogue No. 72-002 (Ottawa: Queen's Printer, January 1967 and January 1970); D.B.S., *Quarterly Bulletin of Agricultural Statistics*, Catalogue No. 21-003 (Ottawa: Queen's Printer, January 1967); D.B.S. Unpublished Statistics.

five of the seven sectors fell below the composite average, basic agriculture had the lowest weekly wages and salaries, and the rest of agribusiness and renewable natural resources showed relatively the same average industrial composite wage. Thus the cheapest labour available in the processing sectors is apparently in agribusiness.

Capital Investment

Capital investment in Canada by sector is an aid in determining the total cost of entry and maintenance of a firm within a specific sector. Table 4 displays annual capital investment, net capital investment, and total capital investment for six aggregated sectors. Investment per employee figures are useful when comparing sectors or industries. These are calculated in Table 4.

Gross capital stock per employee relates the total capital investment in the firm at midyear to the number of 1966 employees. The manufacture of personal items is approximately 7,765 dollars, as compared with agribusiness at 18,248 dollars. Nonrenewable natural resources at approximately 120,081 dollars per employee results in the greatest gross capital stock per employee in the economy.

Net capital stock per employee relates gross capital stock minus total capital consumption allowance (depreciation) to the number of 1966 employees. Net capital stock is lowest in the manufacture of personal goods of approximately 4,437 dollars, followed immediately by agribusiness (excluding agriculture) of 10,510 dollars.

Gross annual capital investment per employee relates the 1966 gross capital investment to the number of 1966 employees. The manufacture

Table 4

CAPITAL INVESTMENT, CANADA, 1966

Area of Expenditure	No. of Employees	Gross Annual Capital Investment (million $)	GACI per Employee ($)	Gross Capital Stock (million $)	GCS per Employee ($)	Net Capital Stock (million $)	NCS per Employee ($)
Basic agriculture	551,000	994	1,804.0	12,313	22,346.6	6,908	12,537.2
Agribusiness[1]	418,994	371	885.5	5,387	12,857.0	3,287	7,845.0
Total agribusiness	969,994	1,365	1,407.2	17,700	18,247.5	10,195	10,510.3
Renewable natural resources	69,839	132	1,890.1	1,436	20,561.7	847	12,127.9
Nonrenewable natural resources	109,784	1,288	1,173.2	13,183	120,081.2	8,852	80,631.1
Personal items	388,143	233	574.5	3,014	7,765.2	1,722	4,436.6
Public items	854,837	2,064	241.5	20,408	23,873.5	12,688	14,842.5
Services and trade	1,781,089	7,829	4,395.6	110,822	62,221.5	74,967	42,090.5
Total employees and investment	4,173,686	12,901	3,091.0 (average)	166,563	39,907.0 (average)	109,271	26,180.0 (average)

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[1] excluding basic agriculture

Sources: D.B.S., Employment and Average Weekly Wages and Salaries, Catalogue No. 72-002 (Ottawa: Queen's Printer, January 1967); D.B.S., Private and Public Investment in Canada, Catalogue No. 61-205 (Ottawa: Queen's Printer, January 1967), Titles used are synonymous with those used by the D.B.S.

Table 5

TOTAL INVESTMENT IN CAPITAL AND LABOUR, CANADA, 1966

Sector	Weekly Wage per Employee ($)	50 Weeks Yearly Wage per Employee ($)	Gross Annual Capital Investment per Employee ($)	Total Annual Wage and Capital Investment per Employee ($)
Basic agriculture	49.75	2,487.50	1,804.00	4,291.50
Agribusiness[1]	93.57	4,678.50	885.50	5,564.00
Total agribusiness	68.68	3,434.00	1,407.20	4,841.20
Renewable natural resources	85.00	4,250.00	1,890.10	6,140.10
Nonrenewable natural resources	138.25	6,912.50	1,173.20	8,085.70
Personal items	90.47	4,523.50	574.50	5,098.00
Public items	115.82	5,791.00	241.50	6,032.50
Services and trade	93.10	4,655.00	4,395.60	9,050.60
Average	99.46	4,973.00	3,091.00	8,064.00

[1] excluding basic agriculture

Source: Tables 3 and 4.

of public items at 242 dollars per employee is followed by the manufacture of personal items and nonrenewable natural resources at 575 and 1,173 dollars respectively.

In relation to industrial averages in each of the aforementioned categories, capital investment per employee in agribusiness is low.

Total Annual Investment in Capital and Labour

Total annual investment in capital and labour measures the cost of operating a firm or industry for a one-year period.

By amalgamating Tables 3 and 4, total investment in capital and labour may be determined by sector for Canada in 1966. These calculations appear in Table 5.

Using data from the study the agribusiness sector requires the least capital investment per year to operate per employee. While agribusiness requires 4,841 dollars per employee to operate, the manufacture of personal items requires 5,098 dollars. Services and trades require high capital and labour investment at 9,051 dollars per employee per annum.

Total annual investment of capital and labour in the agribusiness sector has the property of low capital entry barriers and a low capital requirement for operation.

"Concentration" of Canadian Manufacturing Industries, 1964

"Concentration seems to refer mainly to the ownership or control of a large proportion of some aggregate of economic resources or activity either by a small proportion of the units which own or control

the aggregate, or by a small absolute number of such units" [Bain, 1968, p. 85].

Overall concentration in the Canadian economy gives some indication of the importance of the largest companies (disregarding intercorporate relationships), many of which operate in several industries. Concentration is one of the elements that affect the conduct of firms and, in turn, the economic performance of the economy. It is a matter of concern for public policy because it is an important element in determining the extent to which effectively competitive forces are working in the marketplace.

"The degree of concentration refers to both (a) the number and (b) the size distribution of the units which own or control a given economic aggregate (such as sales or assets), the size of each being measured by the proportion of the aggregate it owns or controls" [*Ibid.*, p. 86].

The North American approach is to determine the present ownership or control held by the largest four, eight, and twenty firms. This study does not follow this approach. The following table categorizes 33,793 establishments of the manufacturing sector. Both the number of establishments and the percent of total establishments that account for 80 percent of the total value of shipments are calculated. An inverse relationship prevails. The higher the number of establishments, the lower the concentration. The same is true for the percentage figures. From these calculations, agribusiness appears to be the least concentrated aggregate, followed by personal and public items. The Canadian manufacturing industry is dominated by approximately 22 percent of the firms (22 percent produce 80 percent).

Table 6

CONCENTRATION OF CANADIAN MANUFACTURING INDUSTRIES, 1964

Sector[1]	Total Number of Establishments	Account for 80% of the Shipments Number	Percent
Agribusiness[2]	10,804	2930.0	27.12
Personal items	8,416	1565.4	18.60
Public items	14,573	2824.3	19.38
Total	33,793	7319.7	21.66

[1] Sectors are defined in Appendix D.

[2] excluding basic agriculture, but including fish products industry

Source: See Appendix E.

Canadian Wholesale and Retail Trade Emphasizing Agribusiness

The structure of agribusiness in the wholesale and retail trade of Canada in 1966 is documented in Table 7. An increase in percent of trade attributed to agribusiness from the wholesale to the retail level is observed in assets, equity, and net income. Net income rises from 20.8 percent to 36.5 percent. At the same time, liabilities, gross income, and expenses decrease.

By use of conventional accounting methods wholesale and retail trade in agribusiness products account for one-quarter to one-third of the categories in Table 7.

Table 7

CANADIAN WHOLESALE AND RETAIL TRADE EMPHASIZING AGRIBUSINESS

1966 ($ million)

Trade	Assets	Liabilities	Equity	Gross Income	Expense	Net Income
Wholesale Trade						
Agribusiness	1,731.4	1,101.2	630.1	5,977.3	5,910.9	66.6
Total	7,811.4	4,925.0	2,886.4	18,592.0	18,270.9	321.0
Agribusiness as a % total	22.1	22.4	21.8	32.2	32.4	20.8
Retail Trade						
Agribusiness	1,406.8	700.1	706.7	4,263.0	4,175.2	87.8
Total	5,606.9	3,147.8	2,459.1	14,635.9	14,395.2	240.7
Agribusiness as a % total	25.1	22.2	28.7	29.1	29.0	36.5
Total Trade						
Agribusiness	3,138.2	1,801.3	1,336.8	10,240.3	10,086.1	154.4
Total	13,418.3	8,072.8	5,345.5	33,227.5	32,666.1	561.7
Agribusiness as a % total	23.4	22.3	25.0	30.8	30.9	27.5

Source: D.B.S., Corporation Financial Statistics, Catalogue No. 61-208 (Ottawa: Queen's Printer, 1966).

Business Results of Canadian Agribusiness

This section presents an appraisal of the business results of aggregated sectors of the economy through the evaluation of an Industrial Balance Sheet, performance ratios, and ownership figures. Ownership figures are included under performance because of increased interest in Canada in using ownership as a measure of performance.

Summary Balance Sheet Emphasizing Agribusiness

Table 8 presents a summary balance sheet with a breakdown for the sectoral aggregates considered so far. These data are subject to the limitation that not all financial statistics for all corporations in Canada in 1966 are included. These data, obtained from Corporation Financial Statistics published by D.B.S., are based on a sample of 14,163. This sample includes all corporations with assets of five million dollars and over, 50 percent of corporations with assets between one and five million dollars, and 5 percent of all corporations with assets less than one million dollars. In total the sample held over 81 percent of the total assets of all corporations.

The following ratios derived from Table 8 will show the financial position of all five aggregates when measured by conventional balance sheet standards. The ratio of current assets to current liabilities for agribusiness excluding the farmer is 1.81. The current ratio has value in estimating the ability of the industry to pay its current debt from presently owned assets. These assets are expected to become available for expenditure in the form of cash within one year of the date of the balance sheet. Unless experience furnishes a more satisfactory ratio

Table 8

INDUSTRIAL BALANCE SHEET EMPHASIZING AGRIBUSINESS

CANADA, 1966 ($ million)

	Basic Agriculture	Agribusiness[1]	Other Goods Producing Industries	Total Goods Producing Industries
Current assets	-*	4,206.2	12,977.3	17,299.4
Total assets	19062.7	8,655.9	23,588.4	32,755.6
Current liability	-	2,323.9	7,257.1	9,702.6
Total liability	3444.2	4,225.5	11,428.3	15,954.4
Noncurrent liability	-	1,901.6	4,171.2	6,251.8
Net worth	15618.5	4,430.4	12,460.7	17,101.8
Current assets/current liabilities	-	1.81	1.79	1.78
Net worth/total liabilities	4.54	1.05	1.09	1.07
Net worth as a percent of total assets	81.9	51.2%	52.8%	52.2%
Current assets as a percent of total assets	-	48.6%	55.0%	52.8%
Noncurrent liabilities as a percent of total liabilities	-	45.0%	36.5%	39.2%

[1] excluding basic agriculture

* - denotes data not available

Source: D.B.S., Corporation Financial Statistics, Catalogue No. 61-208 (Ottawa: Queen's Printer, 1966); D.B.S., Quarterly Bulletin of Agricultural Statistics, Catalogue No. 21-003 (Ottawa: Queen's Printer, 1966).

standard, a ratio of 2 to 1 [Schermerhorn and Page, 1970] usually indicates a reasonable margin of safety. None of the aggregates in Table 8 have reached this level of safety.

The following two ratios are used to test an industry's solvency. This is the ability of an industry to meet the interest costs and repayment schedules associated with its long-term obligations. The Net Worth to Total Liabilities Ratio is computed by dividing Net Worth by Total Liabilities. For the agribusiness corporation the net worth amounts to 1.05, or 105 percent of total liabilities. Agriculture has a ratio of 4.54. Because the invested funds (net worth) serve as a guarantee to cover the liquidation of credit or liabilities, the smaller the net worth and the larger the liabilities, the less security creditors normally possess. If liabilities exceed net worth, creditors have more at stake in the business than the owners.

The ratio of Net Worth to Total Assets is obtained by dividing net worth by the depreciated book value of total assets. For the agribusiness corporation net worth is 51.2 percent of total assets. For agriculture it is 81.9 percent.

The allocation of funds within an industry is further appraised by figuring current assets as a percent of total assets. This ratio determines the liquidity of an industry. Agribusiness has only 48.6 percent liquidity, as compared with 52.8 percent for total goods producing industries.

Noncurrent liabilities as a percent of total liabilities also affects the liquidity of an industry. Noncurrent liabilities do not

affect working capital as much as do current liabilities. Repayment on noncurrent liabilities is spread over a much longer period of time. Agribusiness excluding agriculture has 45.0 percent of total liabilities in the noncurrent category; total goods producing industries have only 39.3 percent.

Financial statement analysis is one of the many tools which management uses to increase managerial efficiency in formulating administrative and operating policies. In addition, the financial statement provides data from which creditors, owners, and prospective investors can judge the effectiveness of the business management. They can determine the profitability of the industry for its owners and forecast future operation results and financial ability to meet its obligations.

Agribusiness Income Statement

An income statement gives the sources of the firm's income, describes the nature of its expenses, and shows the amount of net income earned or net loss incurred by an enterprise or industry during the accounting period. The income statement is important to creditors and for income tax purposes. Table 9 presents an elementary income statement for various sectors of the Canadian economy in 1966. Basic agriculture is represented only by incorporated firms; use of these in comparisons are limited. The high annual capital investment per dollar of net income in agriculture in relation to other industrial classifications is depicted. An annual capital investment in agribusiness of 80 cents returns one dollar in net income. An annual

Table 9

AGRIBUSINESS INCOME STATEMENT, CANADA, 1966 ($ million)

	Income	Expense	Net Income	Annual Capital Investment per $ of Net Income	Net Capital Investment per $ of Net Income	Net Income per Employee
Basic agriculture	4,295.0	2,347.0	1,948.0	51.0	35.0	3,535.40
Agribusiness[1]	12,250.7	11,794.4	456.3	0.8	7.2	1,089.04
Total basic agriculture plus agribusiness	12,595.6	12,124.5	471.1	2.9	21.6	485.67
Other goods producing industries	21,477.6	20,090.2	1,387.4	2.7	17.4	975.25
Total goods producing industries	34,073.2	32.214.7	1,858.5	6.2	53.3	623.39

[1] excluding basic agriculture

Source: D.B.S., *Corporation Financial Statistics*, Catalogue No. 61-208 (Ottawa: Queen's Printer, 1966); D.B.S., *Quarterly Bulletin of Agricultural Statistics*, Catalogue No. 21-003 (Ottawa: Queen's Printer, 1966).

capital investment in other goods producing industries of approximately 35 dollars returns one dollar in net income. Basic agriculture requires approximately 51 dollars annual capital investment to return a net income of one dollar.

Net capital investment per dollar of net income in 1966 was very low for agriculture in relation to other sectors. Again, agribusiness was the next lowest. Agribusiness uses approximately 7 dollars in net capital investment for a return of one dollar in net income. Other goods producing industries need approximately 17 dollars of net capital investment for a return of one dollar in net income. Basic agriculture requires a net capital investment of 4 dollars to return one dollar of net income.

Net income per employee figures are relevant measurements of business results for all sectors of the economy. Basic agriculture returned approximately 3535 dollars per employee in 1966. Agribusiness returned approximately $1,089 for every employee; other goods producing industries returned $975. Each agribusiness worker produced over $100 more in net income in 1966 than a worker in the aggregate of all other goods producing industries.

Canadian Ownership in Industry

Foreign control and ownership have become important facets of

Canadian industry, but the extent of such control differs widely industrially and regionally. Because of economic similarity and complementarity and for a variety of other reasons, such as language and proximity, foreign control and ownership of Canadian industry are concentrated largely in the United States [Canada Department of Industry, Trade and Commerce, December 1969, p.34]. This section examines the extent of Canadian ownership of Canadian industry. Ownership is used as one criterion to measure the performance of an industry.

The Corporations and Labour Unions Returns Act[1] permits the accumulation of ownership data for a well defined segment of the business community. Because its primary purpose is to investigate the participation of nonresidents, the segment which is required to report is comprised of virtually all nonresident interests. Consequently, the nonreporting segments are almost 100 percent Canadian. Therefore, proportions derived from only reporting corporations will exaggerate the relative significance of nonresidents in the economy as a whole.

The proportion of resident investment in each industry group is determined in relation to total corporations including both reporting and non-reporting corporations. The effect is to reduce the relative significance of nonresident corporations by about one-third from the proportions if only CALURA corporations were included. The effect varies widely with respect to industrial sectors.

Table 10 presents an aggregated sectoral approach to the ownership question. Ownership by Canadians of assets, equity, sales, and profits is stressed. Averages for the Canadian economy range from approximately 62 to 75 percent Canadian ownership. Nonrenewable natural

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[1] CALURA

Table 10

PERCENTAGE CANADIAN OWNERSHIP IN INDUSTRY, 1966

Sector	Assets	Equity	Sales	Profit
Agribusiness	68.19	64.63	68.76	65.35
Nonrenewable natural resources	33.06	35.80	29.99	40.90
Renewable natural resources	84.24	78.53	84.73	83.33
Personal items	42.26	41.96	42.70	33.74
Public items	47.58	45.76	48.12	41.96
Services and trade	87.35	82.51	95.37	81.49
Weighted average	74.66	65.80	72.41	62.05

Source: Canada Department of Industry, Trade and Commerce, Annual Report of the Minister of Industry, Trade and Commerce under the Corporations and Labour Unions Return Act, Part I., Corporations, 1966 (Ottawa: Queen's Printer, December 1969).

resources, which include mining and fuel industries, appear to have the highest concentration of foreign ownership with the manufacturing of personal items not far away. At the other end, services and trades appear to be very highly Canadian owned. Agribusiness, with a range of 65 to 68, is more highly concentrated in Canadian ownership than two Canadian averages, in sales and profit. The overall dominance of Canadian ownership is apparent from this table, with Canadian controlled firms holding 75 percent of total assets, making two-thirds of total sales, holding 66 percent of equity, and making 62 percent of profits.

Chapter Three has provided a descriptive approach to the definition of the conventional agribusiness sector in the Canadian economy. Various accounting procedures contributed to the appraisal of the structure and performance of the agribusiness sector.

The subsequent chapters will provide an alternative framework on which the study of agribusiness, or for that matter any other sector of the economy, may be based. This framework is known as input-output analysis. It is developed not to replace the preceding form of evaluation, but to complement it.

CHAPTER IV

THEORETICAL STRUCTURE OF INPUT-OUTPUT ANALYSIS

Being an economic model, the input-output system is derived from a set of assumptions about economic behavior and a set of definitions of the variables involved. It is an accounting system that provides a framework for measuring the flows of current inputs and outputs among the various sectors of the economy. Chapter Four discusses input-output analysis in the theoretical development of a Canadian model for 1966.

Input-Output Accounting[1]

Input-output accounting can be regarded as an aggregation of data describing our economic system by means of an analytical technique for explaining and predicting the behaviour of our economic system. An "idealistic" table of an economy has one row and one column for each sector of the economy and shows, for each pair of sectors, the amount or value of goods and services that flowed directly between them, in each direction, during a stated period. The tables are arranged so that the entry in the i^{th} row and the j^{th} column gives the flow from the i^{th} sector to the j^{th} sector. The formal properties of the input-output accounting system are represented in Figure 1.

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[1] This section paraphrases the theoretical structure of input-output analysis as explained by Chenery and Clark [Chenery and Clark, 1959].

FIGURE 1

INTERINDUSTRY ACCOUNTING SYSTEM

Purchasing Sectors

		Intermediate Use				Final Use					Total Use - Total Supply	Supply	
		Sector 1···j···n				Investment	Consumption	Government	Exports	Total Final Use		Imports	Production
Producing sector	1	X_{11}····	X_{1j}····	X_{1n}	W_1	I_1	C_1	G_1	E_1	Y_1	Z_1	M_1	X_1
	2	·		·									
	·	· (Quadrant II)		·		(Quadrant I)							
	i	X_{i1}	X_{ij}	X_{in}	W_i	I_i	C_i	G_i	E_i	Y_i	Z_i	M_i	X_i
	·	·		·									
	n	X_{n1}····	X_{nj}····	X_{nn}	W_n	I_n	C_n	G_n	E_n	Y_n	Z_n	M_n	X_n
Total produced inputs		U_1	U_j	U_n									
Primary inputs (Value added)		V_1	V_j	V_n		V_I	V_C	V_G	V_E		V		V
		(Quadrant III)				(Quadrant IV)							
Total production		X_1	X_j	X_n		I	C	G	E	Y	Z	M	X

Source: H.B. Chenery and P.G. Clark, Interindustry Economics (New York: John Wiley and Sons, 1959), p.16.

The separation between intermediate and final use and between produced and primary inputs leads to four types of transactions, which are shown in the table and quoted from Chenery and Clark as follows:

> "Quadrant I contains the final use of produced commodities and services, broken down by major types of use."

> "Quadrant II comprises the main part of the interindustry accounts. Each entry, X_{ij}, indicates the amount of commodity i used by sector j, measured in constant prices. The total intermediate use of any commodity is identified as W_i, and the total purchases from other sectors by a given industry as U_j."

> "Quadrant III contains the use of inputs which are "primary" in the sense of not being produced within the system. In a static model, the use of existing capital stock is a primary input, as is the use of the customary primary factors, labor and land. (When output is valued at market prices, indirect taxes must also be treated as a primary input to make the accounts balance.) The total payment for primary inputs by each sector therefore corresponds approximately to the value added in production, being the difference between the value of output and cost of inputs produced outside the given establishment."

> "Quadrant IV contains the direct input of primary factors to final use, of which the main examples are government employment and domestic service."

The formal structure of input-output analysis can best be expressed in symbols. The basic elements are defined as follows:

X_i = total production of commodity i.

Y_i = total final demand for commodity i.

Z_i = total supply or total use of commodity i.

M_i = imports of commodity i by all sectors of the economy.

W_i = total intermediate or interindustry use of commodity i.

X_{ij} = use of commodity i by sector j.

U_j = total intermediate inputs purchased by sector j.

V_j = total purchases of primary inputs by sector j.

These basic concepts lead to two balance equations, one representing the row entries, the other representing the column entries. The first equation applies to the rows of Figure 1. It states that the total supply of each commodity equals the total demand for each commodity:

$$Z_i = M_i + X_i = \Sigma_j X_{ij} + Y_i = W_i + Y_i . \quad (i = 1 \ldots n) \qquad (1)$$

The second equation applies to the columns of Figure 1. It states that the total value of production of each sector is equal to the total value of inputs purchased from other intermediate sectors plus the value added in the form of primary inputs by the sector:

$$X_i = \Sigma_i X_{ij} + V_j = U_j + V_j . \quad (j = 1 \ldots n) \qquad (2)$$

These equations provide the basic formulas for the interindustry accounting system.

Production Theory of Input-Output Analysis[2]

Input-output analysis is essentially a simplified general theory of production. The input-output model is based on the premise that it is possible to divide all productive activities in an economy into sectors whose interrelations can be expressed in a set of simple input functions.

The Leontief model is derived from three basic assumptions:

1) Each commodity is supplied by a single industry or sector of production. Corollaries of this assumption are a) that only one method is used for producing each group of commodities and b) that each

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[2] One might also refer to this section as the Assumptions of Input-Output Analysis, for the essential assumptions of input-output theory are concerned almost entirely with the nature of production. (See Chenery and Clark, Ibid.)

sector has only a single primary output.

2) The inputs purchased by each sector are a function only of the level of output of that sector (it is often assumed that the input function is linear).

3) The total effect of carrying on several types of production is the sum of the separate effects (rules out external economies and diseconomies).

The Sector Concept

Economic theory is based on the assumption of uniformity in the characteristics and behaviour of certain basic units. In its first theoretical formation, the Leontief sector was, like the Marshallian or Walrasian industry, assumed to be composed of plants producing a single homogeneous product by similar techniques. Aggregating all activities into sectors has assumed importance in converting the model into an empirical tool.

For most types of input-output analysis, the basis for aggregation is a similarity of input structure. Even though a strong dissimilarity in output exists, a change in composition of output will have no effect on the inputs required from other sectors if this criterion is satisfied. A second basis for aggregation is the use of outputs of several processes in fixed proportion. This condition is most likely to be met in successive stages of processing the same material.

Formal justification of these conditions results from answering: by what circumstances can sectors m and n be consolidated without affecting the production estimates for the other sectors in the model? The input coefficients of the consolidated sector may be stated as follows:

$$X_{(m+n)} = X_m + X_n \qquad (3)$$

$$a_i(m+n) = \frac{X_i(m+n)}{X(m+n)} = \frac{X_{im} + X_{in}}{X_m + X_n}$$

$$= \frac{a_{im}X_m + a_{in}X_n}{X_m + X_n} = a_{im}\left(\frac{X_m}{X_{m+}X_n}\right) + a_{in}\left(\frac{X_n}{X_m + X_n}\right)$$

$$= W_m a_{im} + W_n a_{in}, \text{ where } W_m = \left(\frac{X_m}{X_m + X_n}\right).$$

If all the input coefficients, $a_{i(m+n)}$, of the consolidated sector are unaffected by changes in the output levels, $X_m + X_n$, the demands of the consolidated sector for the output of other sectors will be equal to the sum of the demands of its components, because the total output, $X_{(m+n)}$, is equal to the sum $X_m + X_n$. Equation (3) shows that there are two conditions under which this is true:

(1) if a_{im} equals a_{in}, then no change in the weights resulting from changes in the proportions in which X_m and X_n are demanded will affect the aggregate coefficient;

(2) if X_m and X_n are demanded in fixed proportions, the weighted average of the input coefficients will always be the same, regardless of differences in its components. The first condition is a criterion for aggregating productive activities, the second, for aggregating commodities.

If rigidly applied, the above conditions would lead to perfect

aggregation. The choice is among combinations of sectors which satisfy this criterion to varying degrees. It is necessary for the analyst to look beyond the direct relations among sectors and consider the effects of their indirect relations as well. Because of the nature of the firms in which production and consumption data are collected, a third type of aggregate will inevitably occur in input-output tables: the aggregation of substitutes. Sectors aggregated in this way will have unstable input coefficients unless the productive processes also have similar inputs.

The preceding three conditions are aimed at aggregation to produce the minimum average error for all the production totals of the solution.

Classification decisions are aided by the recognition of natural divisions of productive sequences resulting from a combination of technological, economic, and locational factors. Both vertical and horizontal aggregation could be used. Vertical is identified with the raw material and the finished product; horizontal is based on a similarity of process. From a statistical point of view, the alternatives for forming sectors are severely limited by the nature of the data available.

The Input Function

The input-output analysis, the general production function of the form:

$$X_j = f(X_{1j}, X_{2j} \dots X_{nj}) \qquad (4)$$

takes the form of minimum requirements for each input:

$$X_j \leqslant X_{ij}/a_{ij}, \; (i=1 \dots n). \qquad (5)$$

This is because of the no-substitution assumption. Equation (4) states

that a minimum amount of each input is required for a given output [Dorfman, Samuelson, and Solow, 1958, Chs. 9 and 10]. The output is, therefore, fixed by whichever limit is reached first.

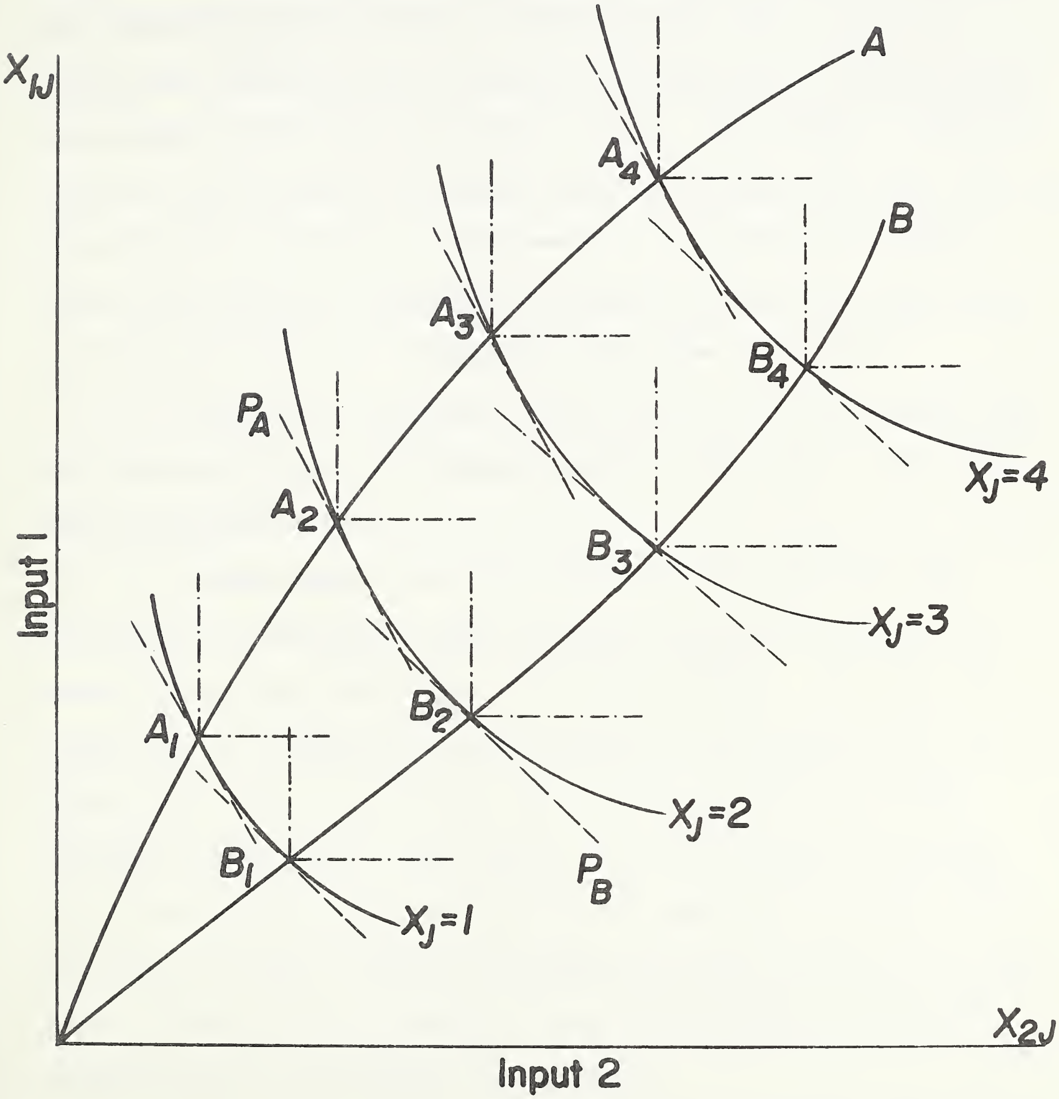
The absence of substitution among inputs may be explained by either i) the level of technology is such that no substitution is possible or ii) relative prices do not change, so that it is not effective to alter input proportions no matter what the shape of the production function. In his original formulation, Leontief relied on the first assumption. He argued that a large proportion of what economists usually call substitution was caused by the use of large aggregates, such as "consumption," in which a change in the proportion of automobiles and foodstuffs consumed, for example, would cause a change in the proportion of inputs of labour and capital required.

This type of substitution is eliminated by the use of a finer sector breakdown. As for true substitution in a productive process, Leontief says that there may be a high degree of complementarity among inputs, so that changes in relative prices will affect their proportions only slightly. Complementarity is more likely in the short run when equipment cannot be varied than it is in the long run.

A more precise discussion of the Leontief hypothesis might proceed as follows. It is assumed that substitution requires a change in the type of machinery so that existing equipment fixes current input proportions. Figure 2 depicts the long run and short run production functions for a given plant. The long run production function is shown by solid lines, while the fixed plant function is given by the L-shaped dashed lines. If existing plants had been built with price ratios

FIGURE 2

LONG RUN AND SHORT RUN PRODUCTION FUNCTIONS FOR SECTOR j



Source: H.B. Chenery and P.G. Clark, Interindustry Economics (New York: John Wiley and Sons, 1959), p.40.

indicated by the set of price line P_a, the proportions in which they use inputs 1 and 2 would be given by the corresponding expansion line A. The input coefficients for the whole industry would be a weighted average of the ratios (X_{ij}/X_j) for plants of different sizes (eg., A_1, A_2, A_3). These ratios would be stable as long as the proportion of output coming from plants of different sizes did not change. If a change in relative prices to P_b is assumed, the optimum input proportions would then lie along line B. New plants or replacements of old plants would embody these proportions, and gradually the weighted average would shift from A_2 to B_2 (or to B_3 if the average plant size also increased).[3]

The Leontief hypothesis can be tested by detailed engineering and statistical studies of individual plants rather than by using time series for whole sectors.

Dorfman [Ibid.] and others have shown that there are both theoretical and empirical grounds for expecting relative prices to be fairly stable apart from periods of wartime shortages. They have concluded that in a competitive system having only one scarce factor (or fixed relative prices of factors) and no joint production, relative commodity prices will be fixed and the choice of productive techniques in each sector will not be affected by the composition of demand. Even if there is a range of possible techniques and input proportions in each sector, there will be no tendency to vary these proportions unless the relative prices of the primary inputs change.

Klein [Klein, 1953] questioned whether or not the input coefficients in the Leontief system should be interpreted as physical constants,

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[3] The weighted average need not lie on the expansion line unless the shape of the production function is restricted.

as does Leontief, or as value ratios which combine the effects of changes both in relative prices and in quantities. He suggests that his interpretation is more in line with economic theory and that there may be a greater stability in value ratios than in physical input-output ratios, reflecting an elasticity of substitution among inputs close to unity. An empirical model built on Klein's hypothesis would be more complicated to apply than Leontief's[4] because the quantity solution is dependent upon the price solution.

The degree of stability of input functions depends in part on the way the sectors are selected and in part on the underlying properties of the productive system. Observed changes in these relations come from three sources: (1) changes in the composition of demand (product mix); (2) changes in relative prices of inputs; and (3) changes in the technological alternatives available.

Developing an Input-Output Model

In developing an input-output model, determination of the size of the table and of the manner in which producing industries can be aggregated or added together into producing sectors, since both size and aggregation may vary depending upon the uses the table is intended to serve, is most important. In economic analysis the basic business unit is a firm, and all firms producing similar goods or using similar outputs are regarded as comprising an industry. The basic problem facing the analyst is that of reducing the number of individual industries, which may number in the hundreds of thousands, existing in the economy

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[4] Leontief's analysis is made in constant prices of the base year, and output levels are independent of price changes.

to a workable number (from 30 to 100) by aggregating sectors with similar input and output structures.[5]

When the size and sectoral composition of the table is decided upon, the matrix of interindustry transactions in dollar values[6] is prepared. The transactions matrix is converted into a technical input coefficient matrix showing direct industry purchases per unit of output. The technical coefficient of production is defined in economic theory as the amount of the output of industry i required to produce one unit of output of industry j. This definition conforms with the physical aspect of production. Within the context of input-output analysis, however, the technical coefficient represents the flow of goods from one industry to produce a unit of output in another domestic industry. The difference in treatment lies in the fact that in input-output analysis the technical coefficients need not represent the total requirements of one input because such things as imports may be included in the output of the industry.

From the technical coefficient matrix one may derive the Leontief matrix and eventually the Leontief inverse matrix of interdependence coefficients.[7] The interdependence coefficients serve to explain the total direct and indirect requirements of each industry's output required to meet a given final demand. These coefficients are used

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[5] It must be remembered that greater aggregation, although easier to work with, leads to less detailed results.

[6] The original "tableaux economiques" were constructed on a physical unit basis. Leontief developed his tables on a dollar basis to obtain some means for comparisons and aggregations.

[7] The mathematical construction of the derivation of the matrices is discussed in Appendix C.

to develop output multipliers for the whole economy.

To develop a precise definition of the interdependence coefficients and to express the relation with the technical coefficients, one may consider a set of constants B_{ij}, i = (j-l...n), where B_{ij} reflects the sum of the direct and indirect inputs of commodity i required by the economic system in order to deliver one dollar of output of industry j to the final demand sector. These B_{ij} coefficients, it should be noted, are independent of any changes in the nature and composition of the final demand sector. They are a means of evaluating the impact of a change in the final demand sector upon the output structure of the region that is less cumbersome than a round-by-round iterative process of evaluation. For example, any increase in final demand for agricultural products necessitates, not only an increase in the output of agricultural products, but also an increase in the outputs of other industries which supply inputs to the agricultural industry; hence, indirectly an increase in regional income and employment.

The mechanical process of computing the secondary effects of changes in final demand is reduced to a bare minimum when the interdependence coefficients[8] are calculated as a function of known technical coefficients. In this procedure of evaluation of the impact of final demand, the interdependence coefficients are necessarily treated as constants, for they are based on the assumption of constancy of technical coefficients. As a result they are subject to the same limitation as the technical coefficients; that is, the trade flows relate to a single year.

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[8] Interdependence coefficients are a measure of the reliance of one sector upon other sectors of the economy.

Controversy over the theoretical points on which the Leontief System rests has become widespread. The argument can best be summed up by the following statement made by C. Christ:

> The preceding appraisals of input-output analysis from theoretical and empirical points of view are clearly inconclusive. The theoretical appraisal cannot be conclusive by itself because the question is one of usefulness in the real world, and the empirical appraisal cannot be conclusive until more evidence is known. I plead for the preparation of data on the final bill of goods and the total outputs of industries for several different years, so that it can be seen how well the 1947 matrix (and any future one) works, not for just one year, but for several years . . . . The input-output technique is certainly better than no technique. What are the alternatives? Clearly, a real general equilibrium system would be the best, barring cost, but this is not a realistic alternative. Clearly, linear programming would be better than input-output if the relevant data were developed to the same degree, for it would have all the advantages of input-output analysis plus the added advantage of being able to deal automatically with substitution among inputs. It is not a practical alternative at present even though it may become one. I believe that input-output is the best technique now available for handling problems that require a picture of the production function of the entire economy, and that its results can serve as first approximations from which to start making corrections where special information permits or experience demands [National Bureau of Economic Research, 1955, pp. 168-169].

Thus far empirical evidence has neither proved nor disproved the validity of the results from the technique.

The foregoing theoretical framework has given the reader a brief introduction to the use and preparation of an input-output model. With this basic theoretical framework in hand, one may now proceed to investigate some of the specific definitions and classifications used in the construction of the Canadian model for 1966.

Developing a Canadian Input-Output Model for 1966

Input-output tables in Canada form a part of a broader system of National Accounts which includes the Income and Expenditure Accounts,

the Indexes of Real Domestic Product by Industry, Productivity Studies, the Financial Flow Accounts, the Balance of International Payments, and potentially, balance sheets showing the assets and liabilities of the economy. The System of National Accounts was originally developed to satisfy the need for consistent and comprehensive measures of economic activity. As new demands for data for economic analysis have grown over the years, the conceptual framework has been refined. Input-output tables became a part of the National Accounts in 1956 when a table for 1948 was completed. In 1969 a table for 1961 was added. The present study develops an input-output table for 1966. Input-output theory as implemented by Leontief provided the basic groundwork. Because of theoretical and empirical problems specific only to the Canadian economy, divergences from the Leontief approach occurred. The Canadian input-output tables for 1948 and 1961 served as guidelines in determining which diversions were both plausible and possible.

This section details the construction of the 1966 model. The accounting framework of input-output tables is discussed for the newly constructed model, and the results of the model are explained in light of conventional national accounting methods. A detailed classification and definition of the sectors of the table are given through the use of the Standard Industrial Classification Manual [Dominion Bureau of Statistics, 1960].

Accounting Framework of the 1966 Input-Output Model

Figure 3 contains a schematic presentation of the detailed

FIGURE 3

SCHEMATIC ACCOUNTING FRAMEWORK OF THE 1966 CANADIAN INPUT-OUTPUT TABLE

	Good Producing Industries	Service Producing Industries	Dummy Industries	Exports	Re-exports	Imports	Inventory Change	Final Demand	Total Output
Good Producing Industries	1 ·············· 74 · · · · · · · · 74	75 · 85	86 · 88	89	90	91	92	93	
Service Producing Industries	75 · 85								
Dummy Industries	86 · · 88								
Commodity Tax	89								
Government Services	90								
Wages and Salaries	91								
Unincorporated Net Income	92								
Surplus	93								
Total Input								G.N.E.	G.E.A.
Gross Domestic Product by Industry									G.D.P.

accounting framework for the 1966 Input-Output Table.[9] This figure represents a matrix of the Canadian system partitioned into 64 compartments or submatrices. The figure does not illustrate the relative sizes of the submatrices; some are very large while others involve only one row or one column.

The entries in the submatrices represent transactions among industries, persons, governments, and nonresidents. These transactions are classified according to categories of transactors, according to the object being transacted, and according to the purposes for which one of the transactors enters into transaction. Because any transaction involves two transactors and can be classified by object and by the purpose of one of the transactors, a simultaneous classification of transactions according to all these criteria would require a diagram. Figure 3 consolidates some of the classifications of transactions. These consolidations are not uniform; in different parts of the accounts different consolidations are used, depending upon the availability of information and on the form in which the data is most useful for analytical purposes.

The input-output table for 1966 is composed of 93 input-output sectors. The industry is the sector classification. An industry is a collection of individual producing units which are grouped together on the basis of some common characteristics.

The unit used is the establishment, the smallest unit for which such accounting records are available. In the case of a firm or enterprise which carries on a variety of activities, there is a problem of

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[9] This form of presentation is consistent with the recommended international practice established by the United Nations Statistical Commission in its revision of the Systems of National Accounts [United Nations, Department of Economic and Social Affairs, 1968].

dividing the entity into a number of homogeneous units suitable for statistical analysis. To define a separate production process or activity means adopting a unit smaller than that used by firms or enterprises for their accounting records of outputs and related inputs.

The Dominion Bureau of Statistics Standard Industrial Classifi- Manual [*Ibid*.] presents a system of classification for establishments in both the business and noncommercial sectors.[10] The term "industry" is employed in this study in a special sense; the term refers to the business sector only.[11]

If an establishment produces two products, its industrial classification depends upon which of the two products represents the larger share of its gross value of production. Each industry usually produces several characteristic or "principal" products; in many instances it also produces secondary products. Some of the secondary products may be services as well as goods.

In analyzing economic interdependence it is necessary to maintain the link between the original sources of supply of a good and the intermediate or final consumer of that good. To this end, the wholesale and retail trade industries are not shown as consumers of the goods which they purchase nor as producers of that which they sell. Their trading outputs are defined as the gross margins on goods traded with the inputs defined accordingly.

It is customary to express the measures of inputs and outputs

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[10] This classification system is used in Appendix A to define the sectors of the 1966 model.

[11] This definition of industry is consistent with the definition adopted by the United Nations [United Nations, *op*. *cit*.].

of commodities in input-output tables on the same basis of valuation. The basis of valuation used is the "producer's value" (or value at "producer's prices,"[12] defined to be the selling value at the output boundaries of the producing establishments, excluding any sales or excise taxes levied after the final stage of processing).

Data Limitation

The data used in constructing the input-output flow table was obtained from aggregated corporation income tax returns for 1966.

Severe limitations existed in the data that were made available. Private and public institutions in Canada do not collect data on a commodity or industrial classification basis. A firm's total output is attributed to that sector from which its largest share of output comes. This presents problems when developing technical input-output coefficients.

Further limitations were encountered in that many foreign-owned corporations in Canada are not presently required to report their specific financial positions to the Canadian government. No data existed for these firms.

Data on the service industries were sparse. Available figures were open to question. Analysis of the service industry's technical coefficients must be considered carefully before being quoted.

An aggregation problem existed because many government and private agencies collect data under varying aggregated classifications. Although a Standard Industrial Classification Manual [Dominion Bureau of Statistics, 1960] exists, it is not widely used.

The word "agriculture" encompasses all aspects of farming. It is recognized that the input structures of various farm enterprises, for example, a beef and a grain enterprise, vary widely. Agriculture is not

homogeneous, as input-output theory requires an aggregate to be. The input structure included in the present input-output table is a farming aggregate and, as such, overemphasizes the particular input structure of some subsectors and underestimates that of others. Data limitations prevented a farm enterprise breakdown of agriculture. For this particular study such a restriction was not deemed serious because the agriculture sector formed only one part of the analysis of Canadian agribusiness.

The Industry Accounts and Other Entries

The basic matrix is composed of 74 goods producing industries and 11 service producing industries. This matrix contains the demands of each industry from each other industry for the purpose of using the commodities as intermediate inputs in the production of other commodities. It is the industry's consumption or use of the commodity which must be related to the industry's production in input-output analysis.

The total cost of a commodity laid down at the using establishment (purchaser's value) will often include for-hire transportation charges, trade margins (if the good passes through one or more trading establishments), and commodity taxes, such as sales taxes or excise duties, these "margins" being additional to the producer's value. A uniform valuation at the producer's level is preferable because the amounts of transportation charges, trade margins, and commodity taxes included in the purchaser's value of commodities vary considerably from one purchaser to another. Consequently, the above 85 industry matrix entries do not contain the actual transaction values of industries with their suppliers; rather they represent estimates of the relevant producer's values

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[12] For domestically produced commodities, the term "producer's value" corresponds to "approximate basic value" in the United Nations System of National Accounts [Ibid.].

of the transactions. Any for-hire transportation charges and any trade margins are treated as separate commodity inputs. Any commodity taxes levied after the producer's value stage and included in the purchaser's value are shown as inputs in the row entitled "Commodity Taxes."[13] The total costs of each industry include the full value of all transactions with suppliers for intermediate purposes. The methods of valuation and treatment of transport, trade, and commodity tax margins for commodities purchased by final demand categories of transactors are identical to those employed for the intermediate demands of industries.

Built upon the original 85-sector input-output matrix are three sectors of dummy industries. Although establishments report most of their commodity inputs in considerable detail, some inputs can only be reported in catchall categories. The information required to estimate the detailed commodity content of these categories of inputs for each industry is not available. These inputs were handled through the device of dummy industries. The analytical implication of the technique is that, under the assumption of industry technology, the detailed composition of a particular dummy industry (column) used by each industry is in proportion to the commodity and commodity tax inputs of the corresponding dummy industry (row).

Further construction of the input-output table requires different titles for row and column. These are discussed under the headings "Further Column Entries" and "Further Row Entries."

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[13] This excludes import duties, which are part of the producer's values of imports.

Further Column Entries

Column 89 Exports: Exports from Canada of goods and services produced in Canada are accounted for here. The sign is positive because an addition is made by exports to the nation's balance of payments.

Column 90 Re-exports: Exports from Canada of goods and services imported into Canada are accounted for here. No physical change in the appearance of the product while in Canada can have taken place.

Column 91 Imports: Imports of goods and services into Canada are accounted for here. Imports are entered in the column sector as negative because they contribute to a decrease in positive balance of payments.

Column 92 Inventory Change: Inventory change contains the values of the physical changes in inventories of commodities held by industries. An entry refers to the total change in the inventories of an industry whenever held in the business sector. The valuation of inventory change presents special problems because firms employ a variety of inventory accounting methods. Various adjustments are made in order to estimate the "value of the physical change" in inventories based on average current period producer's prices.

Column 93 Final Demand: Final demand shows the expenditure on final goods and services by governments, businesses, and individuals. No breakdown is made of the expenditures into current or capital. Any revenues of governments from their production and sale of commodities are treated as negative entries. The final demand

vector is the result of a Leontief open system, which was discussed earlier in this chapter.

Further Row Entries

Row 89 Commodity Taxes: Row vector 89 accounts for commodity taxes levied beyond the producer's price valuation level on the commodities used by the industry for intermediate purposes and the sum of commodity tax totals on the purchases of commodities by final demand categories. The principal taxes represented here are the federal manufacturers' sales tax, excise taxes and duties, provincial water taxes, and provincial and municipal sales taxes. Custom import duties, being part of the producer's values of imports, are not included.

Row 90 Government Services: The Government Services vector accounts for

1) Government subsidies received by industries on current account operations. The entries are negative because the subsidies are revenues to industries.

2) For each industry, noncommodity indirect taxes including property taxes plus certain government fees and licensing charges which are treated as indirect taxes in the Income and Expenditure Accounts [Dominion Bureau of Statistics, National Accounts, Incomes and Expenditures, Annual]. Comparable data are also presented for persons, governments, and nonresidents.

3) Payments by industries for certain services produced in the government sector which are considered unique to government. Comparable payments by persons, governments, and nonresidents are included. In addition to certain registration fees, licenses,

and similar charges not treated as indirect taxes in the Income and Expenditure Accounts, such payments as harbour dues, airport landing fees, and tuition charges by educational institutions in the government sector are also included.

Row 91 Wages and Salaries: Row vector 91 contains wages and salaries and supplements any labour income of employees in industries, private nonprofit institutions, domestic households, public and civilian employees in government, and military pay and allowances.

Row 92 Unincorporated Net Income: Row vector 92 accounts for the net incomes of unincorporated businesses including returns to the labour contribution of proprietors for whom no separate wage and salary estimates are made.

Row 93 Surplus: Row vector 93 represents a residual surplus calculated for each industry as the difference between the value of the industry's total output and its costs. These entries contain (a) for incorporated business--profits on productive activity (before corporation income tax and before payments of interest and dividends) and capital consumption allowances; (b) for unincorporated businesses--capital consumption allowances, the nonfarm inventory valuation adjustment, and certain other valuation adjustments.

Relation of the 1966 Canadian Input-Output Table to National Accounts[14]

The input-output accounts are on a "domestic" basis; they are

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[14] Appendix B gives a numerical relation from the theory expressed in this section.

concerned with the costs of production of, and the expenditure on the output of, producing units in the domestic economy, regardless of the residence of the primary factors of production used by these producing units. The main tables of the Income and Expenditure Accounts are on a "national" basis.

The measures of production for income and expenditure accounts and their main components can be calculated from input-output accounts by aggregating certain detailed parts of the latter. On the expenditure side, the relevant measure is Gross Domestic Expenditure at market prices (GDEm). The measure is gross because the cost of fixed capital consumed during the year has not been deducted. It is a net output measure and, therefore, avoids duplication to the extent that intermediate goods and services used by industries in the production of other goods and services are excluded. In the Income and Expenditure Accounts, GDEm is estimated directly as the sum of final expenditures at market prices by persons, governments, industries, and nonresidents (exports) less total purchases of goods and services from nonresidents (imports). In Figure 3 these expenditure totals appear as the sum of the entries in the column of the Input-Output Account titled "Final Demand" by persons, governments, and industries. Purchases from and sales to nonresidents have already been accounted for by columns 89, 90, and 91.

Gross National Expenditure at market prices is equal to Gross National Product at market prices on the income side of the account. They are defined and related as follows:

Personal expenditure on goods and services.............	Wages, salaries, and supplementary labour income........
Government expenditure on goods and services:	Military pay and allowances.....

- Current expenditure.............
- Gross fixed capital formation....

Business gross fixed capital formation.........................
- New residential construction.....
- New nonresidential construction....................
- New machinery and equipment......

Value of physical change in inventories......................
- Nonfarm business inventories.....
- Farm inventories and grain in commercial channels........

Exports of goods and services.......
Deduct: Imports of goods and services.........................

Corporation profits before taxes..........................
Deduct: Dividends paid to nonresidents.................
Rent, interest, and miscellaneous investment income.....
Accrued net income of farm operators from farm production...................
Net income of nonfarm unincorporated business.............
Inventory valuation adjustment...
Net national income at factor cost..........................
Indirect taxes less subsidies....
Capital consumption allowances and miscellaneous valuation and adjustments..............

Gross National Expenditure at market prices................... = Gross National Product at market prices................

On the income side of Income and Expenditure Accounts, the usual measure is that of production in Gross Domestic Product at market prices (GDPm). GDPm is equal to the sum of wages and salaries, net income of unincorporated business, surplus, and indirect taxes.

The most commonly used measure of output originating by industry is Gross Domestic Product at factor cost (GDPf), which excludes indirect taxes but includes capital consumption allowances. There is no unique way of distributing indirect taxes by industries, particularly taxes on commodities. The relationship between Gross National Product at market prices and Gross Domestic Product at factor costs follows.

Income and Expenditures	Input-Output
Gross National Product at market prices	Gross Domestic Product at factor costs
Deduct: Indirect taxes less subsidies Income received from nonresidents Add: Income paid to nonresidents	Sum: Row 91--Wages and Salaries Row 92--Net Income Unincorporated Row 93--Surplus
Gross Domestic Product at factor cost	

Gross Domestic Product at factor costs can also be calculated by input-output accounting by industry by summing the entries in Rows 91, 92, and 93 for each individual industry.

A figure rarely used in national accounting systems is Gross Economic Activity or Gross Total Income of the economy. Double and multiple accounting appears in this account. The sum of total output or input of all sectors determines this figure, found in the last entry of the input-output account (Row 94, Column 94).

Reconciliation of National Accounts, Income and Expenditure and the Input-Output Table for 1966

In 1966, D.B.S. National Accounts, Income and Expenditure reported a Gross Domestic Product (G.D.P.) of 50,741 million dollars. Table 11 presents a comparison of results obtained by the two techniques utilized in this study. Input-output accounting arrived at a G.D.P. figure by aggregating wages and salaries, net income, unincorporated, and surplus. Income and expenditure accounting arrived at a figure that was 1,209 million dollars greater than that derived by input-output accounting. The two accounting techniques arrived at similar figures for the G.D.P. of mining, transportation and storage, wholesale and retail trade,

Table 11

CONCILIATION OF INPUT-OUTPUT AND NATIONAL ACCOUNTS, GROSS DOMESTIC PRODUCT AT FACTOR COST, 1966

($ million)

Input-Output		National Accounts[1]	
Aggregated			
Wages and salaries	28,848.750	Total GDP	50,741.000
Net income, unincorporated	5,320.359		
Surplus	15,362.977		
Total GDP	49,532.152		
Disaggregated			
Agriculture	2,706	Agriculture	2,952
		Forestry	497
Forestry, hunting, and fishing	838	Fishing and trapping	147
Iron, base metal, and uranium	1,094	Total forestry, fishing, and trapping	644
Coal, petroleum, and natural gas	728	Mining, quarrying, and oil wells	2,024
Asbestos and other nonmetals	350	Manufacturing	13,107
Total mining	2,172	Construction	3,174
		Transportation	2,999
Manufacturing[2]	18,656	Storage	126
Construction	3,715		
Transportation and storage	3,405	Total transportation and storage	3,125
Communication	1,295	Communication	1,223
Utilities	1,590	Electric power, gas, and water utilities	1,572
Wholesale and retail trade	6,308	Wholesale trade	2,392
		Retail trade	4,374
Finance, insurance, and real estate	4,611	Total wholesale and retail trade	6,766

continued

Table 11 (continued)

Health and education	580	Finance, insurance, and real estate	4,965
Business services	837	Public administration and defense	3,523
Hotels	776	Services	7,666
Restaurants	836		
Other services	1,208		
Total services[3]	4,237		

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[1] D.B.S., National Accounts, Income and Expenditure, 1967, Catalogue No. 13-201 (Ottawa: Queen's Printer, 1968).

[2] Services relating to manufacturing are included in manufacturing total.

[3] Expenditures on public administration and defense are included in sector of expenditure.

* Summations not equal to totals due to rounding.

finance, utilities, and communication. Equating of services proved difficult because services relating to manufacturing are included in the manufacturing total.

Other income and expenditure accounts can be drawn up from the input-output accounts and are demonstrated numerically for 1966 in Appendix B.

Chapter Four has developed the theory of input-output analysis and applied it to the construction of a Canadian model for 1966. The input-output tables developed from this theory are available in a separate appendix upon request. Chapter Five takes an initial step in interpreting the results so that they become a meaningful and useful aid to private and public policy makers.

CHAPTER V

AGRIBUSINESS IN THE CANADIAN ECONOMY

Chapter Three presented a conventional approach to an appraisal of the role of agribusiness in the economy by means of simple accounting methods. With the introduction of input-output theory and the development of an input-output model for Canada in Chapter Four, the original definition of agribusiness presented in Chapter Three can be reevaluated. Input-output analysis evaluates one particular sector in relation to the remaining sectors of the economy. Chapter Five thus redefines the Canadian economy with respect to its input-output, external trade, and final demand structures in 1966. The input-output flow table is reconstructed to develop a diagramatic flow system for the agribusiness system. This system is analyzed in further detail by the study of individual subsystems composing the agribusiness system.

The Input-Output Structure of the Canadian Economy

The input-output method of appraising the structure of an economy provides a more detailed and flexible approach than has previously been available through the application of simple accounting methods. Table 12 is designed to demonstrate the structural relationships. One column shows differences in the disposition of commodities between customers who require the commodities for further processing and end use customers. A second column classifies domestic inputs into purchases of intermediate goods for further processing, purchases of labour, and a third category, surplus, which includes other measurable inputs. A third column identifies commodities that are traded between countries

Table 12

INPUT-OUTPUT CHARACTERISTICS OF CANADIAN INDUSTRY, 1966

Sector	Customer Class	Input Class	External Class	Noncorporate Activity
1. Agriculture	P	K	X	U
2. Forestry, hunting, and fishing	P	K		U
3. Iron, base metal, uranium	P	K	M X	
4. Fuel minerals	P	K	M X	
5. Nonmetal mining	P	K	X	
6. Meat and poultry processors	C	S L		
7. Dairy factories	C	S L		
8. Processed cheese	C	S K		
9. Fish products industry	C	S L		
10. Fruit and vegetable canners	C	S L	M	
11. Feed mills	P	S L		
12. Flour mills	P	S L	X	
13. Breakfast cereal manufacturing	P	S L		
14. Biscuit manufacturing	C	S L		
15. Bakeries	C	S L		U
16. Confectioneries	C	S L	M	
17. Sugar refineries	C	S K	M	
18. Vegetable oil mills	P	S K	M X	
19. Miscellaneous food manufacturing	C	S L	M	
20. Soft drink manufacturing	C	L		
21. Distilleries	C	K		
22. Breweries and wineries	C	S L		
23. Leaf tobacco processing	P	S L		
24. Tobacco products manufacturing	C	S L		
25. Rubber products	P	S L		
26. Leather tanneries	P	S L	M	
27. Shoe and leather manufacturing	C	S L		
28. Cotton yarn and cloth	P	S L	M	
29. Wool yarn and cloth	P	S L	M	
30. Synthetic textile mills	P	S L		
31. Other textiles	P	S L	M	
32. Other knitting mills	P	S L	M X	
33. Clothing industry	C	S L		
34. Wood industry	P	S L	X	
35. Furniture manufacturing	C	S L		
36. Pulp and paper mills	P	S K	X	
37. Asphalt roofing	P	S L		
38. Paper containers	P	S L		
39. Printing and publishing	P	L	M	
40. Iron and steel mills	P	S L		
41. Steel pipe and tube mills	P	K	M	
42. Iron founderies	P	S L		
43. Smelting and refining	P	S L	M X	
44. Aluminum processing	P	S L	X	
45. Copper processing	P	S L	M X	
46. Metal processing	P	S L	M X	
47. Boiler and plate metal	P	S L	M X	

continued

Table 12 (continued)

	Sector	Customer Class	Input Class	External Class	Noncorporate Activity
48.	Fabricated and structural metal	P	S L	M X	
49.	Ornamental and architectural metal	P	S L		
50.	Metal stamping	P	S L		
51.	Wire and wire products	P	S L		
52.	Hardware and cutlery	P	S L	M	
53.	Other metal industries	P	S L		
54.	All other machinery and equipment	P	S L	M X	
55.	Refrigerator and store machinery	C	S L		
56.	Aircraft and parts	C	S L	M X	
57.	Motor vehicles manufacturing	C	S L	M	
58.	Vehicle parts manufacturing	P	S L	M	
59.	Other transportation equipment	C	S L		
60.	Manufacturing electrical appliances	C	S L		
61.	Communications and wire manufacturing	P	S L	M	
62.	Electrical industrial equipment	C	S L	M	
63.	Other electrical products manufacturing	C	S L		
64.	Cement and lime	P	K		
65.	Concrete and gypsum	P	S L		
66.	Clay and stone	P	S L		
67.	Glass and glass products manufacturing	P	S L	M	
68.	Petroleum products industry	P	S K		
69.	Chemicals industry	P	S K	M X	
70.	Mixed fertilizer manufacturing	P	S L	M X	
71.	Pharmaceuticals	C	S L	M	
72.	Paint and varnish	P	S L		
73.	Soaps and cleaners	C	S L		
74.	Miscellaneous manufacturing	P	S L	M	
75.	Construction	C	S L		U
76.	Wholesale and retail trade	C	L		U
77.	Transportation and storage	P	L		
78.	Communications	P	L		
79.	Utilities	P	K		
80.	Finance	C	K		U
81.	Health and education	C	L		U
82.	Business services	P	L		U
83.	Hotels	C	L		U
84.	Restaurants	C	S L		U
85.	Other services	C	L		U

Key: C: Intermediate output less than final demand.
K: Surplus is greater than salaries and wages.
L: Surplus is less than salaries and wages.
M: Imports greater than 20 percent of total output.
P: Intermediate output greater than final demand.
S: Intermediate input greater than 50 percent of total input.
U: Net income of unincorporated business greater than 3 percent of total input
X: Exports greater than 20 percent of total output

Source: Derived from input-output tables.

in relatively significant quantities. The last column is used to identify sectors in which a significant share of total activity is carried on by nonincorporated business.

Nonincorporated businesses were defined to be relatively significant producers of a commodity if the profits accruing to such businesses exceeded 3 percent of total production. When these profits of unincorporated businesses were sufficiently large, that is in excess of 3 percent, a U was placed in the noncorporate activity column in Table 11. Eleven commodity groups were so qualified.

One of the difficulties in determining the relative significance of nonresident ownership under the Corporations and Labour Returns Act is the exclusion of domestically dominated unincorporated business activity. Examination of the significance of unincorporated business as treated in the input-output table reveals that the industrial sectors in which this type of activity is important are all Canadian dominated. It is also probable that the degree of nonresident participation in nonresident dominated sectors was not overstated in Chapter Three of this thesis because unincorporated activity does not appear to be significant in these sectors.

Customer Class

The total output of a commodity may be allocated between other production processes and end uses. That portion of the production which becomes an input into another commodity is referred to as intermediate output. End uses include sales to consumers, governments, and businesses (or domestic final demand) and sales abroad (or exports).

Intermediate outputs may be considered as sales to corporations.

The domestic final demand category is dominated by consumption, although fixed capital formation is also included. This category may be considered as sales to consumers, especially when governments are considered consumers. The output of each commodity group was examined to determine which category was larger, intermediate output or domestic final demand. Where intermediate output was larger in dollars, a P (for producer) was placed in the customer class column. If the domestic final demand category was larger, a C (for consumer) was used.

Total inputs--those factors required for the production of commodities--are classified as intermediate inputs (goods which have already been subjected to some processing), wages and salaries, net profit of unincorporated business, and surplus. Although imports add to the domestic supply of a commodity, they are generally considered as a deduction from output, rather than as an input, to arrive at a domestic production figure. Where intermediate inputs contributed more than one-half of all inputs of any commodity, an S (for supplier oriented) was placed in the input class. The relative importance of interindustry links is immediately apparent from the relative frequency with which the S appears.

Input Class

The inputs of an industry are divided into intermediate inputs--those commodities being subjected to further processing--and primary inputs. Primary inputs consist of indirect taxes, which are ignored in this study, wages and salaries, which are self-explanatory, and surplus. Surplus is defined as the sum of the costs of, or incomes accruing to, capital employed in production in the form of profits and other investment income, plus the cost of the consumption of the stock of fixed

capital employed, that is, depreciation. In a sense, surplus may be considered to be the "wages and salaries" of machinery, equipment, and other items of capital employed in the production of goods and services. To compare the relative significance of capital and labour, surplus was compared with salaries and wages. Where salaries and wages exceeded surplus, an L was placed in the input class. Where surplus was the larger, a K was placed in the input class.

External Trade Class

Imports add to the domestic supply of a commodity. If imported goods are of a class or kind made in Canada, they are considered as a deduction from output to determine the domestically produced supply. In some cases, imports do not compete with domestic production. These non-competing imports, which are relatively insignificant, are treated as inputs.

Competing imports and exports were compared with industrial outputs inclusive of intermediate output and after deducting competing imports. If these imports exceeded 20 percent of this output, an M was placed in the external trade column. If exports exceeded 20 percent of output, an X was placed in the external trade column.

Basic classification of industrial sectors by external trade characteristics as in Table 11 provides a basis upon which to review the implications of control apart from direct ownership. For example, control may be exercised by domestic or foreign suppliers if they dominate the purchases or input of a firm. Control may also be exercised by customers if they account for a sufficiently large proportion of sales or output.

A more detailed appraisal of indirect control through external trade follows with the aid of Table 13. Total exports and imports appear, along with the respective percentages of total output. A point to remember is that total output is calculated by including all interindustry transactions plus all final demand including imports (negative) and exports (positive). Inventory change, which may be positive or negative depending upon an addition or subtraction from inventory for 1966, directly affects imports and exports as a percent of total output. Inventory is a stock; inventory change is a change in stock. Exports may be made out of stock, or imports may be added to stock. Thus it is possible to export or import more than 100 percent of total output, for total output must equal total input or total used by the economy. High import and export percentage figures only reveal sectors highly dependent upon external trade, which in turn reveal sectors whose control is affected by their external trade characteristics.

Total imports for Canada in 1966 were 10524.5 million dollars, as compared with exports of 10808.9 million dollars. Agriculture exported 26 percent of output and imported 5 percent of total output. Meat and poultry processors were less reliant upon external trade; only 2.5 and 2.3 percent of total output were exported and imported respectively. Mixed fertilizer, a farming input sector, exported 93.8 percent of output while importing only 17.4 percent of total output.

The input-output structure of the Canadian economy can be further analyzed by examining the final demand structure of the economy. As was detailed in Chapter Four, the 1966 input-output model for Canada is an "open model." The final demand sector has no constant input coefficients. It is composed of all purchases for final consumption by all

Table 13

TOTAL EXTERNAL TRADE AND AS A PERCENTAGE OF TOTAL OUTPUT BY INDUSTRIAL SECTOR, 1966 ($ million)

Sector	Exports	%	Imports	%
1. Agriculture	1564.2	26.0	296.7	5.0
2. Forestry, hunting, and fishing	245.7	16.1	28.7	1.9
3. Iron, base metal, uranium	1059.2	74.8	249.8	17.6
4. Fuel minerals	491.0	40.9	541.1	45.1
5. Nonmetal mining	324.3	61.9	66.0	12.6
6. Meat and poultry processors	68.2	2.5	61.8	2.3
7. Dairy factories	79.6	6.4	17.3	1.4
8. Processed cheese	0.0	0.0	0.0	0.0
9. Fish products industry	0.0	0.0	0.0	0.0
10. Fruit and vegetable canners	69.3	13.5	170.9	33.2
11. Feed mills	62.6	12.0	60.8	11.6
12. Flour mills	146.6	40.5	0.0	0.0
13. Breakfast cereal manufacturing	0.0	0.0	0.0	0.0
14. Biscuit manufacturing	0.0	0.0	0.0	0.0
15. Bakeries	0.0	0.0	0.0	0.0
16. Confectioneries	0.0	0.0	66.2	20.5
17. Sugar refineries	14.9	8.5	145.0	83.2
18. Vegetable oil mills	118.4	95.6	147.1	118.7
19. Miscellaneous food manufacturing	26.0	4.0	186.8	28.6
20. Soft drink manufacturing	5.9	1.4	0.0	0.0
21. Distilleries	135.5	18.4	26.5	3.6
22. Breweries and wineries	0.0	0.0	17.0	2.0
23. Leaf tobacco processing	50.6	15.2	0.0	0.0
24. Tobacco products manufacturing	0.0	0.0	13.0	1.6
25. Rubber products	10.9	1.8	65.4	10.7
26. Leather tanneries	72.4	124.6	45.9	79.0
27. Shoe and leather manufacturing	7.1	2.3	32.7	10.7
28. Cotton yarn and cloth	0.0	0.0	104.3	21.9
29. Wool yarn and cloth	0.0	0.0	185.7	527.6
30. Synthetic textile mills	0.0	0.0	37.9	7.7
31. Other textiles	48.4	8.9	125.7	23.0
32. Other knitting mills	18.7	69.8	238.2	888.8
33. Clothing industry	27.5	1.2	105.4	4.5
34. Wood industry	650.1	39.0	0.0	0.0
35. Furniture manufacturing	0.0	0.0	77.4	12.6
36. Pulp and paper mills	1612.7	65.5	86.1	3.5
37. Asphalt roofing	0.0	0.0	0.0	0.0
38. Paper containers	34.2	4.2	57.0	7.0
39. Printing and publishing	21.5	2.1	266.9	26.5
40. Iron and steel mills	121.6	12.2	36.8	3.7
41. Steel pipe and tube mills	0.0	0.0	56.8	28.6
42. Iron founderies	30.8	19.6	0.0	0.0
43. Smelting and refining	6.7	0.9	0.0	0.0
44. Aluminum processing	419.1	238.7	52.2	29.7
45. Copper processing	251.0	99.8	18.7	7.4

continued

Table 13 (continued)

Sector	Exports	%	Imports	%
46. Metal processing	409.6	446.2	167.3	182.3
47. Boiler and plate metal	94.5	115.4	160.2	195.6
48. Fabricated and structural metal	46.5	28.7	259.8	160.3
49. Ornamental and architectural metal	0.0	0.0	0.0	0.0
50. Metal stamping	0.0	0.0	0.0	0.0
51. Wire and wire products	0.0	0.0	24.9	6.2
52. Hardware and cutlery	9.5	7.8	56.1	44.1
53. Other metal industries	0.0	0.0	0.0	0.0
54. All other machinery and equipment	434.8	34.3	1824.5	143.8
55. Refrigerator and store machinery	20.0	5.2	69.3	18.1
56. Aircraft and parts	328.0	46.9	180.9	25.8
57. Motor vehicles manufacturing	120.7	5.1	473.0	20.0
58. Vehicle parts manufacturing	84.3	10.9	880.0	114.0
59. Other transportation equipment	69.9	14.3	90.2	18.4
60. Manufacturing electrical appliances	0.0	0.0	0.0	0.0
61. Communications and wire manufacturing	68.4	8.4	212.7	26.1
62. Electrical industrial equipment	27.9	5.7	138.6	28.3
63. Other electrical products manufacturing	0.0	0.0	37.5	5.9
64. Cement and lime	0.0	0.0	0.0	0.0
65. Concrete and gypsum	0.0	0.0	0.0	0.0
66. Clay and stone	39.3	11.4	65.8	19.2
67. Glass and glass products manufacturing	0.0	0.0	66.4	22.0
68. Petroleum products industry	32.8	1.9	179.8	10.2
69. Chemicals industry	270.0	23.7	495.1	43.4
70. Mixed fertilizer manufacturing	114.4	93.8	21.2	17.4
71. Pharmaceuticals	17.3	5.5	78.5	25.1
72. Paint and varnish	0.0	0.0	12.1	5.2
73. Soaps and cleaners	0.0	0.0	0.0	20.0
74. Miscellaneous manufacturing	0.0	0.0	229.8	0.0
75. Construction	0.0	0.0	0.0	0.0
76. Wholesale and retail trade	0.0	0.0	0.0	0.0
77. Transportation and storage	0.0	0.0	0.0	0.0
78. Communications	0.0	0.0	0.0	0.0
79. Utilities	0.0	0.0	0.0	0.0
80. Finance	0.0	0.0	0.0	0.0
81. Health and education	0.0	0.0	0.0	0.0
82. Business services	0.0	0.0	0.0	0.0
83. Hotels	0.0	0.0	0.0	0.0
84. Restaurants	0.0	0.0	0.0	0.0
85. Other services	58.2	3.0	330.3	17.1
Total	10,808.9		10,524.5	

Source: Derived from input-output tables.

individuals, governments, and businesses and in total is equal to Gross National Expenditure or Gross National Product.

Table 14 demonstrates the statistical position of the 85 industrial sectors with respect to final sales or demand. The effect of imports and exports can be minimized if it is realized that percentage figures over 100 percent reflect the greater value of imports than exports for that sector.

Agriculture in 1966 delivered 7.5 percent of output directly to final demand. In the processing subsystem, meat and poultry processors sold 68.1 percent of total output to final demand. Mixed fertilizer manufacturers sold only 4.3 percent of total output to final demand as expected because of the high export rate (Table 13) and the high sales to agriculture (Table 15). The wholesale and retail trades are the agents for a large amount of all sales to final demand. Input-output analysis treats them as agents only; sales to the wholesale and retail trades do not exist as such, only margins paid to the wholesale and retail trades are included.

Input-Output Definition of Agribusiness

The input-output approach can be used to define the relationship between seemingly different sectors of the economy. The procedure is to define a system, in this case agribusiness, and use the input-output technique to determine the relationship of this system to the remaining sectors of the economy on both the input and output sides. A narrow definition of agribusiness is proposed; specifically, agriculture plus the food and

Table 14

PERCENTAGE OUTPUT TO FINAL DEMAND BY
INDUSTRIAL SECTOR, 1966 ($ million)

Sector	Percentage Output to Final Demand
1. Agriculture	7.5
2. Forestry, hunting, and fishing	0.0
3. Iron, base metal, uranium	0.1
4. Fuel minerals	1.5
5. Nonmetal mining	0.2
6. Meat and poultry processors	68.1
7. Dairy factories	70.9
8. Processed cheese	81.5
9. Fish products industry	72.2
10. Fruit and vegetable canners	87.9
11. Feed mills	0.4
12. Flour mills	16.9
13. Breakfast cereal manufacturing	85.2
14. Biscuit manufacturing	80.1
15. Bakeries	88.5
16. Confectioneries	104.3
17. Sugar refineries	89.0
18. Vegetable oil mills	10.5
19. Miscellaneous food manufacturing	76.4
20. Soft drink manufacturing	76.9
21. Distilleries	67.8
22. Breweries and wineries	93.7
23. Leaf tobacco processing	7.1
24. Tobacco products manufacturing	101.3
25. Rubber products	39.5
26. Leather tanneries	1.0
27. Shoe and leather manufacturing	97.9
28. Cotton yarn and cloth	1.2
29. Wool yarn and cloth	9.6
30. Synthetic textile mills	10.9
31. Other textiles	21.0
32. Other knitting mills	481.5
33. Clothing industry	96.2
34. Wood industry	3.5
35. Furniture manufacturing	101.3
36. Pulp and paper mills	5.6
37. Asphalt roofing	13.3
38. Paper containers	0.3
39. Printing and publishing	18.9
40. Iron and steel mills	9.8

continued

Table 14 (continued)

Sector	Percentage Output to Final Demand
41. Steel pipe and tube mills	21.5
42. Iron founderies	21.2
43. Smelting and refining	9.0
44. Aluminum processing	13.1
45. Copper processing	10.6
46. Metal processing	56.8
47. Boiler and plate metal	45.2
48. Fabricated and structural metal	63.4
49. Ornamental and architectural metal	40.2
50. Metal stamping	11.8
51. Wire and wire products	1.9
52. Hardware and cutlery	52.0
53. Other metal industries	37.7
54. All other machinery and equipment	82.9
55. Refrigerator and store machinery	60.6
56. Aircraft and parts	47.6
57. Motor vehicles manufacturing	93.7
58. Vehicle parts manufacturing	15.2
59. Other transportation equipment	85.0
60. Manufacturing electrical appliances	84.5
61. Communications and wire manufacturing	52.8
62. Electrical industrial equipment	72.4
63. Other electrical products manufacturing	61.5
64. Cement and lime	14.6
65. Concrete and gypsum	15.8
66. Clay and stone	22.4
67. Glass and glass products manufacturing	22.8
68. Petroleum products industry	38.4
69. Chemicals industry	12.1
70. Mixed fertilizer manufacturing	4.3
71. Pharmaceuticals	93.3
72. Paint and varnish	6.7
73. Soaps and cleaners	68.6
74. Miscellaneous manufacturing	48.9
75. Construction	84.5
76. Wholesale and retail trade	66.8
77. Transportation and storage	46.8
78. Communications	43.0
79. Utilities	42.8
80. Finance	66.7
81. Health and education	100.0
82. Business services	16.9
83. Hotels	50.1
84. Restaurants	75.7
85. Other services	71.6

Source: Derived from input-output tables.

Table 15

PERCENTAGE INPUT FROM AND OUTPUT TO AGRICULTURE AND FOOD AND BEVERAGE SECTORS, 1966 ($ million)[1]

Sector	% Input From	% Output To
1. Agriculture	26.9	88.7
2. Forestry, hunting, and fishing	1.8	1.6
3. Iron, base metal, uranium	0.0	0.0
4. Fuel minerals	0.1	1.7
5. Nonmetal mining	0.0	2.5
6. Meat and poultry processors	85.7	66.9
7. Dairy factories	81.3	42.0
8. Processed cheese	44.9	24.9
9. Fish products industry	2.6	44.1
10. Fruit and vegetable canners	43.7	47.4
11. Feed mills	68.3	96.7
12. Flour mills	73.5	93.5
13. Breakfast cereal manufacturing	30.8	4.3
14. Biscuit manufacturing	44.8	5.3
15. Bakeries	53.2	0.4
16. Confectioneries	46.6	90.5
17. Sugar refineries	39.4	87.6
18. Vegetable oil mills	89.7	63.6
19. Miscellaneous food manufacturing	46.5	79.6
20. Soft drink manufacturing	40.7	50.5
21. Distilleries	34.7	65.5
22. Breweries and wineries	26.0	10.3
23. Leaf tobacco processing	91.6	100.0
24. Tobacco products manufacturing	58.6	100.0
25. Rubber products	0.2	3.0
26. Leather tanneries	56.1	0.0
27. Shoe and leather manufacturing	0.0	0.0
28. Cotton yarn and cloth	1.1	0.1
29. Wool yarn and cloth	6.8	0.0
30. Synthetic textile mills	2.0	0.1
31. Other textiles	1.5	10.0
32. Other knitting mills	0.0	0.3
33. Clothing industry	2.1	0.5
34. Wood industry	0.1	2.9
35. Furniture manufacturing	0.1	0.0
36. Pulp and paper mills	0.6	3.9
37. Asphalt roofing	0.1	0.0
38. Paper containers	0.1	47.1
39. Printing and publishing	0.0	2.3
40. Iron and steel mills	0.2	0.1
41. Steel pipe and tube mills	0.0	0.0
42. Iron founderies	0.0	0.0

continued

Table 15 (continued)

Sector	% Input From	% Output To
43. Smelting and refining	0.0	0.0
44. Aluminum processing	0.1	0.1
45. Copper processing	0.1	0.0
46. Metal processing	0.2	0.0
47. Boiler and plate metal	0.0	0.0
48. Fabricated and structural metal	0.1	67.5
49. Ornamental and architectural metal	0.0	0.0
50. Metal stamping	0.1	0.0
51. Wire and wire products	0.0	2.7
52. Hardware and cutlery	0.0	0.0
53. Other metal industries	0.1	0.0
54. All other machinery and equipment	0.1	4.6
55. Regrigerator and store machinery	0.0	2.2
56. Aircraft and parts	0.0	1.2
57. Motor vehicles manufacturing	0.0	0.0
58. Vehicle parts manufacturing	0.0	9.5
59. Other transportation equipment	0.0	0.0
60. Manufacturing electrical appliances	0.0	0.0
61. Communications and wire manufacturing	0.0	0.0
62. Electrical industrial equipment	0.0	0.0
63. Other electrical products manufacturing	0.0	0.0
64. Cement and lime	0.0	0.1
65. Concrete and gypsum	0.2	0.0
66. Clay and stone	0.0	0.1
67. Glass and glass products manufacturing	0.0	31.1
68. Petroleum products industry	0.0	27.7
69. Chemicals industry	2.1	11.6
70. Mixed fertilizer manufacturing	0.5	70.4
71. Pharmaceuticals	4.3	16.1
72. Paint and varnish	5.2	0.0
73. Soaps and cleaners	15.6	0.6
74. Miscellaneous manufacturing	0.2	5.7
75. Construction	0.2	9.4
76. Wholesale and retail trade	9.3	12.5
77. Transportation and storage	0.1	16.4
78. Communications	0.0	5.6
79. Utilities	0.0	8.5
80. Finance	0.0	10.3
81. Health and education	0.0	0.0
82. Business services	0.0	9.3
83. Hotels	19.7	2.9
84. Restaurants	73.1	0.0
85. Other services	0.6	4.2

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[1] Sectors 1 and 6-24 taken as a percent of total intermediate sales.

Source: Derived from input-output tables.

beverage sectors.[1] The input and secondary output sectors are omitted.[2] Table 15 presents the percentage input from the agribusiness sectors of total inputs for each sector and the percentage output to the agribusiness sectors of total output from each sector.

Table 16 provides a classification by percentage groups[3] of the statistical results from Table 15. Such a classification allows accurate statistical definition of the aggregated agribusiness sector of the Canadian economy. Unlike the conventional approach of Chapter Three, input-output specifies statistically the interrelations of selling and buying between the agriculture and the food and beverage system and the rest of the Canadian economy. Agribusiness input and output sectors can be identified. Classification of such sectors relies upon subjective decisions regarding lower limits of the input and output sectors' trade with the agriculture, food, and beverage sectors that qualify them to be included in the agribusiness system. The input and output sectors which trade with the agriculture, food and beverage sectors provide a difficult problem with respect to the fact that many firms or sectors engage only partially[4] in agribusiness. Limits applied to define agribusiness broadly were a) any input or output sector that sells or purchases 25 percent or greater of its total output or input to or from the agriculture, food, and beverage sectors, b) any input or output sector that sells or purchases

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[1] Sectors 1 and 6 to 24.

[2] Such a procedure excludes transactions with the external trade and final demand sectors.

[3] Percentage groups were chosen arbitrarily for ease of comparison.

[4] One example is the farm supply industries.

Table 16

CLASSIFICATION OF SECTORS BY PERCENT INPUT FROM OR OUTPUT TO AGRICULTURE, FOOD, AND BEVERAGES

% Inputs From Agriculture, Food, and Beverages	% Outputs to Agriculture, Food, and Beverages
Sectors > 50%	
Meat and poultry processors	Agriculture
Dairy factories	Meat and poultry processors
Feed mills	Feed mills
Flour mills	Flour mills
Bakeries	Confectioneries
Vegetable oil mills	Sugar refineries
Leaf tobacco processing	Vegetable oil mills
Tobacco products manufacturing	Miscellaneous food manufacturing
Leather tanneries	Soft drink manufacturing
Restaurants	Distilleries
	Leaf tobacco processing
	Tobacco products manufacturing
	Fabricated and structural metal
	Mixed fertilizer manufacturing
25% ≤ Sectors ≤ 50%	
Processed cheese	Dairy factories
Fruit and vegetable canners	Fish products industry
Breakfast cereal manufacturers	Fruit and vegetable canners
Biscuit manufacturing	Paper containers
Confectioneries	Glass and glass products manufacturing
Sugar refineries	Petroleum products industry
Miscellaneous food manufacturing	
Soft drink manufacturing	
Distilleries	
Breweries and wineries	
10% ≤ Sectors < 25%	
Soaps and cleaners	Breweries and wineries
Hotels	Other textiles
	Chemical industry
	Pharmaceuticals
	Wholesale and retail trade
	Transportation and storage
	Finance

Table 16 (continued)

5% ⩽ Sectors < 10%	
Wool yarn and cloth	Miscellaneous manufacturing
Paint and varnishes	Construction
Wholesale and retail trade	Communications
	Utilities
	Business services
	Vehicle parts manufacturing

Source: Derived from Table 15.

between 5 and 25 percent of its total output or input to or from agriculture, food, and beverage sectors (these sectors are considered to be partially agribusiness oriented, and only their respective relationships with the agriculture, food, and beverage sectors are considered agribusiness), and c) any sector with less than 5 percent relationship with the agriculture, food, and beverage sectors is not considered to be significantly enough related to agribusiness to be included in a definition of agribusiness. Following these limits, Table 16 displays the input-output definition of Canadian agribusiness.

Input-output results in several unexpected additions to and deletions from the Canadian definition of agribusiness. Category number 1 (>50%) includes under sales (outputs to) fabricated and structural metal which according to the conventional approach proposed in Chapter Two is not included. Category 2 under purchases (inputs from) adds forestry, hunting, and fishing and under sales, fish products industry, paper containers, glass and glass products, and petroleum products. Categories 3 and 4 represent partial agribusiness sectors. Sectors which contradict the full agribusiness relationship defined by the conventional approach

are on the purchase side (inputs from), wool yarn and cloth and paint and varnish, on the sales side (outputs to), breweries and wineries, other textiles, and pharmaceuticals.

The input-output and conventional approach differences occur primarily in the input and the secondary processing sectors. The conventional approach defines agribusiness relating to agriculture alone, the input-output approach defines agribusiness relating to agriculture, food, and beverages. When the input-output approach is used, the input and secondary processing sectors broaden considerably.

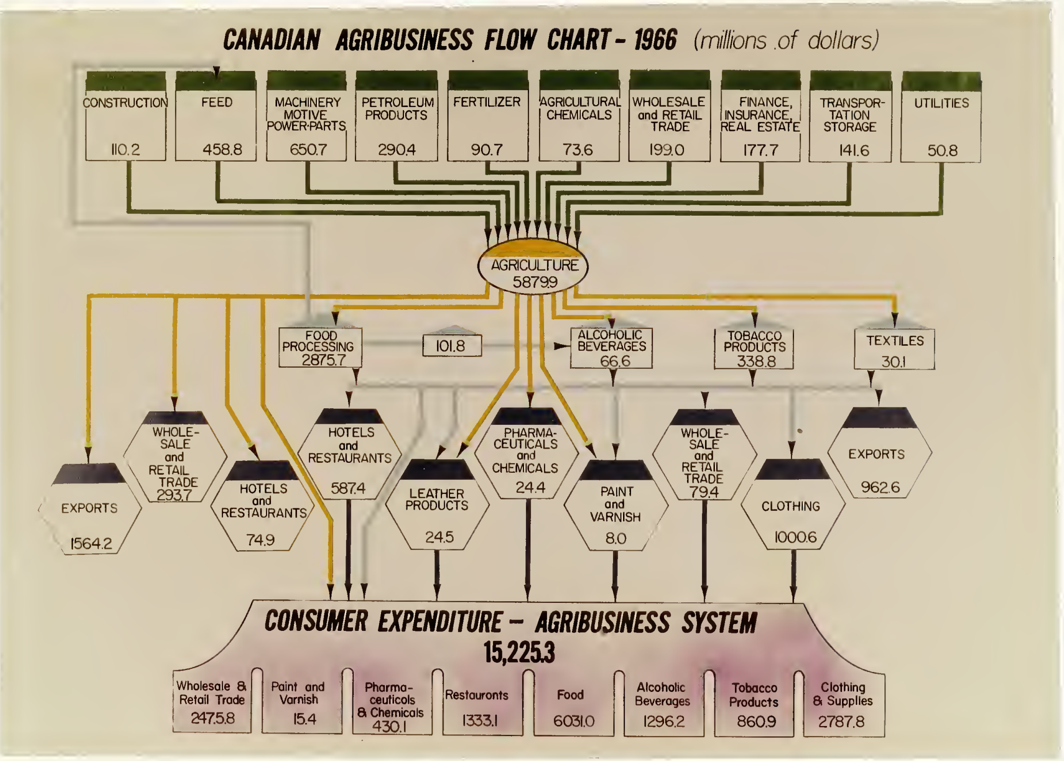
Flow of Canadian Agribusiness Products

Economists, as well as farmers and businessmen, tend to look upon farming and business as basically distinct and separate operations. This thinking is reflected in the makeup of national trade organizations, both general and commodity types; in the administrative arm of government, with its separate Departments of Agriculture and Industry, Trade and Commerce; in the House of Commons, with its separate legislative committees; and in the Canadian educational system, with its schools of business and agriculture largely isolated from one another.

Today a large portion of the agribusiness economy functions off the farm in terms of operations relating to the manufacturing and handling of farm supplies and to the processing, storage, and distribution of farm products. When surveyed as a whole, agribusiness appears to be an entity consisting of numerous functions that are more or less loosely tied together.

Figure 4 is a diagrammatic presentation of the major spheres of agribusiness products within the Canadian economy in 1966. It is a result

FIGURE 4


CANADIAN AGRIBUSINESS FLOW CHART - 1966 (millions of dollars)
CONSTRUCTION 110.2
FEED 458.8
MACHINERY MOTIVE POWER-PARTS 650.7
PETROLEUM PRODUCTS 290.4
FERTILIZER 90.7
AGRICULTURAL CHEMICALS 73.6
WHOLESALE and RETAIL TRADE 199.0
FINANCE, INSURANCE, REAL ESTATE 177.7
TRANSPOR-TATION STORAGE 141.6
UTILITIES 50.8
AGRICULTURE 5879.9
FOOD PROCESSING 2875.7
101.8
ALCOHOLIC BEVERAGES 66.6
TOBACCO PRODUCTS 338.8
TEXTILES 30.1
EXPORTS 1564.2
WHOLE-SALE and RETAIL TRADE 293.7
HOTELS and RESTAURANTS 74.9
HOTELS and RESTAURANTS 587.4
LEATHER PRODUCTS 24.5
PHARMA-CEUTICALS and CHEMICALS 24.4
PAINT and VARNISH 8.0
WHOLE-SALE and RETAIL TRADE 79.4
CLOTHING 1000.6
EXPORTS 962.6
CONSUMER EXPENDITURE – AGRIBUSINESS SYSTEM
15,225.3
Wholesale & Retail Trade 2475.8
Paint and Varnish 15.4
Pharma-ceuticals & Chemicals 430.1
Restaurants 1333.1
Food 6031.0
Alcoholic Beverages 1296.2
Tobacco Products 860.9
Clothing & Supplies 2787.8

Source: Derived from Input-Output Table 1, Appendix K.

of the input-output technique of sectoral definition.[5] The flow channels of agribusiness products, sales to agriculture and purchases from agriculture and their approximate values in 1966, are visibly described in Figure 4.

It may be noted from Figure 4 that in 1966 consumers[6] spent about fifteen billion dollars for the end products and services relating to agribusiness. This represents essentially the total bill paid by consumers for all production, processing, fabricating, and distribution of such end products. Although the aggregate consumer expenditure is expressed in terms of purchaser's values, all remaining items are expressed in producer's values. The differential between producer's and purchaser's prices is accounted for largely by the margin paid to wholesale and retail trade as a service to consumers.

Of this 15 billion dollars worth of consumer items, 5.8 billion dollars came directly from the unprocessed output of Canadian farms. In the production, processing, and distribution of the 15 billion dollars worth of end products from agribusiness, the transactions at the functional levels indicated in Table 17 took place. Important to note here is that the 15.2 billion dollar expenditure by consumers on agribusiness products constitutes roughly 42 percent of the 36.1[7] billion dollar total

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[5] A step-by-step computation of Figure 4 is located in Appendix F.

[6] Consumers include all purchasers of goods for final consumption whether individuals, businesses, or governments.

[7] This figure is obtained from Table 2 of Chapter Three. This pertains specifically to personal consumer expenditure (excluding businesses and governments). It is realistic to equate expenditures on agribusiness products from the input-output table, even though they include businesses and governments; agribusiness products are chiefly consumer products and very little is purchased by businesses and governments as

Table 17

AGRIBUSINESS TRANSACTIONS[1]

Transaction	Value ($ million)
Purchases of manufactured production supplies by farmers	2,243.5
Sales of commodities by farmers	5,879.9
Sales of food and fiber end products by producers	12,309.0
Sales of chemical end products by producers	445.5
Purchases by consumers	15,225.3

[1] Dollar value of transaction will vary with the detail of the breakdown of functions.

Source: Figure 4.

consumer expenditure for 1966.

Fifteen billion dollars and 42 percent serve as yardsticks for measuring the general size and massiveness of agribusiness against the background of the national economy. Even though today's agribusiness system is quite different from the agricultural system of only fifty years ago, it is still part of the economy when both on-farm and off-farm operations are included.

Sector and Aggregate Interrelationships

As a means of viewing quantitatively the inner workings and characteristics of agribusiness and its component parts, the aggregates

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inputs. The difference between the consumer expenditure figure of 15.2 billion dollars of Table 16 and the 13.0 billion dollar figure of Table 2 of Chapter Three may partially stem from the definition of consumers. The remainder results from a slightly more detailed definition of sectors in the input-output approach.

of agriculture, food and beverage processing, fiber processing, and chemical processing are examined. These sectors were selected because each represents an important phase of agribusiness and each appears in identical form on both the input and output sides of the matrix. Although there are other units of agribusiness that are equal in importance, particularly the farm supply industries, to those selected, limitations in basic data prevented a satisfactorily detailed analysis of such units in this study.

In analyzing all units, the sales and purchases of each aggregate are summarized and presented in a pie chart. Sectoral sales and purchases as tabulated in Appendix G provide a comprehensive visual picture of sectoral interrelationships by placing sales and purchases in parallel relationships, rather than in the perpendicular relationships of the input-output table.

The Agriculture Aggregate

The agriculture or farming aggregate both purchased and sold almost 6 billion dollars worth of goods and services in 1966. Its purchases can be divided into three broad categories, the largest being purchases from all other sectors accounting for 49 percent of all purchases, details of which were presented earlier in the Agribusiness Flow Chart. The second general category of purchases by farmers in terms of dollar volume is the factor payment unit, consisting of labour and capital utilization. These factor payments accounted for 46 percent of all farm purchases in 1966, totalling 2.7 billion dollars of which 2.3 billion dollars were for such cost items as depreciation[8] and managerial

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[8] Defined in the input-output table as surplus.

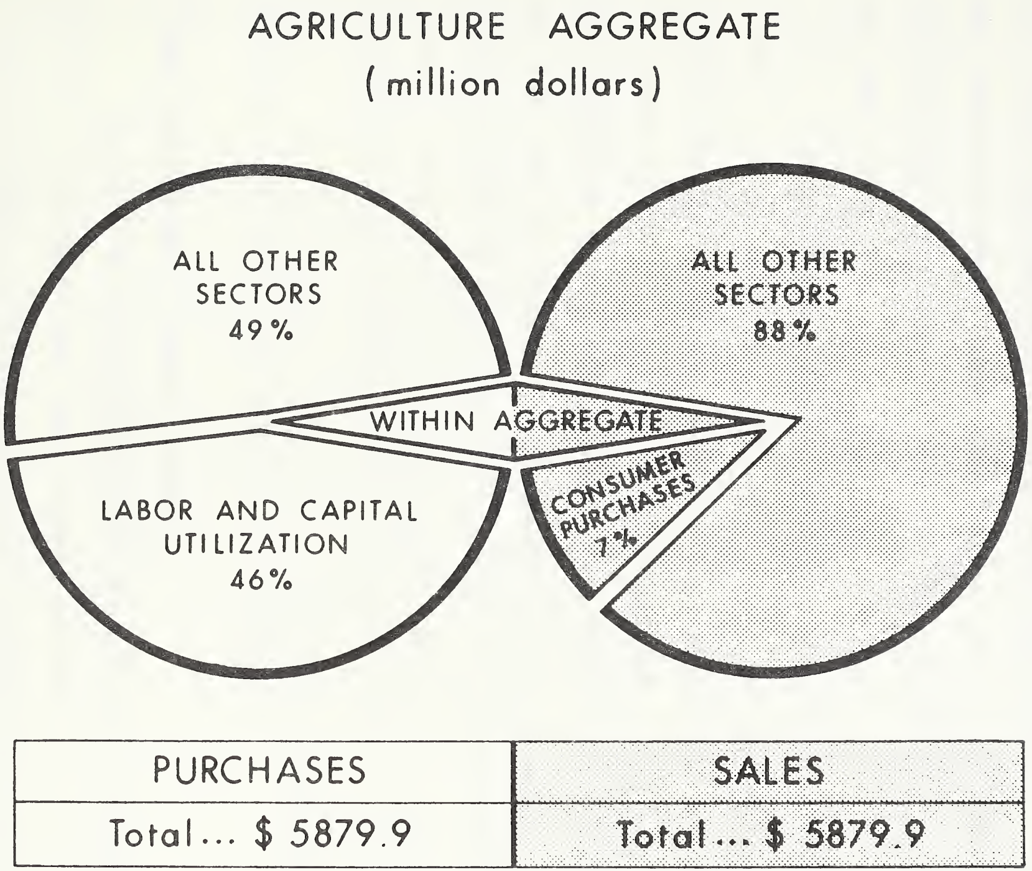

FIGURE 5

PURCHASES BY AND SALES OF THE AGRICULTURE AGGREGATE, 1966

services.[9] The relatively sizable capital payments by the agriculture aggregate are consistent with the large fixed capital structure portrayed in the agribusiness balance sheets in Chapter Three. The remaining 5 percent involved intra-aggregate[10] transactions within farming. In 1966 these amounted to almost 300 million dollars. Such transactions were relatively much higher prior to the advent of mechanization and technology, when animals were the principal source of power.

With respect to sales by the farming aggregate, the largest outlets for farm products were the food and beverage and fiber processing industries of the economy. Sales to these industries accounted for 3.3 billion dollars or 56 percent of total farm sales in 1966. This broad category is important because most farm products require processing before final consumption. Approximately 440 million dollars worth of goods and services moved directly to consumers without intermediate processing. This accounts for approximately 7 percent of total sales. As indicated earlier farmers also sold 5 percent of their output to other farmers. The relationship of both sales and purchases in aggregate are illustrated in Figure 5, sector-by-sector, in Table 22.

The Food and Beverage Processing Aggregate

The food and beverage processing aggregate both purchased and sold about 11 billion dollars worth of goods and services in 1966. The pie chart in Figure 6 indicates that food and beverage processing procured 52 percent of its inputs by purchases from other intermediate

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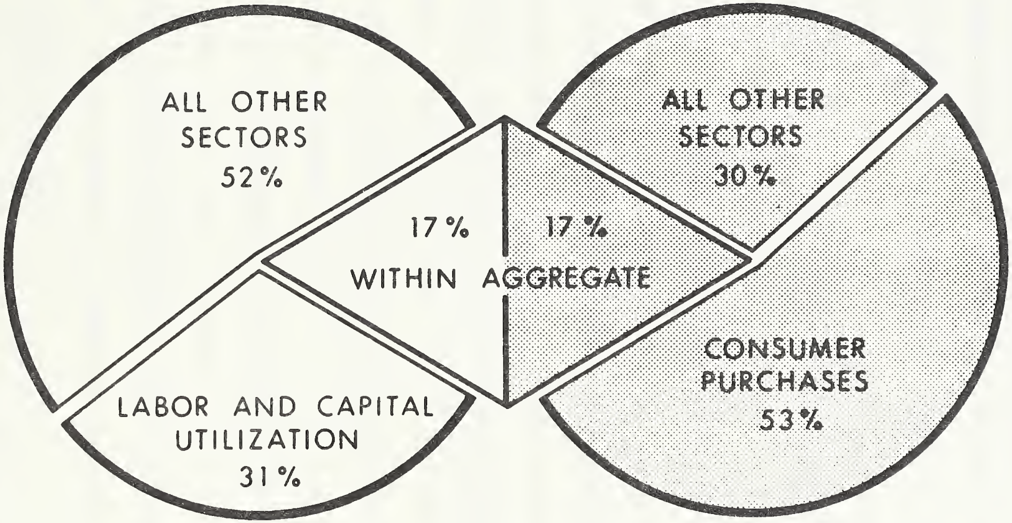
[9] Defined in the input-output table as net income, unincorporated.

[10] Defined as dollar transactions within a sector, or use of a sector's outputs as inputs.

FOOD AND BEVERAGE PROCESSING AGGREGATE

(million dollars)



PURCHASES	SALES
Total $ 11,005.6	Total $ 11,005.6

FIGURE 6

PURCHASES BY AND SALES OF THE FOOD AND BEVERAGE PROCESSING AGGREGATE, 1966

sectors, 31 percent by means of labour and capital utilization, of which 1.8 billion dollars was attributed to wages and salaries and 1.0 billion dollars to depreciation and similar costs. The remaining 17 percent was accounted for through intra-aggregate transactions.

The prime market for the food and beverage processing aggregate is the Canadian consumer. As indicated in Figure 6, this market accounted for 7.7 billion dollars of sales, or 70 percent of total aggregate sales in 1966. Industries in the food and beverage aggregate simultaneously satisfy about 17 percent of their requirements by purchases from one another. Table 1 of Appendix G details specific purchases and sales relationships of the food and beverage processing aggregate to all the sectors and aggregates in the input-output table. The major sectors supplying the food and beverage processing aggregate, with the exception of labour and capital utilization, are located in the farming aggregate. The farming sector sold almost 3.3 billion dollars, or 56 percent, of its output of goods and services to the food and beverage aggregate in 1966. In turn, food and beverage processing sold 504 million dollars worth of goods and services to the farming aggregate, consisting largely of processed food. These purchases account for about 9 percent of total purchases from the food and beverage processing aggregate. These calculations determine the reciprocity that exists between the food and beverage processing industries and the farming industry.

The interrelationships between the agriculture aggregate and the food and beverage processing aggregate are further explored in Table 17. This table demonstrates the buyer-seller relationship between the two aggregates in 1966. The food processing aggregate is dependent upon

Table 18

PURCHASES FROM AND SALES TO THE FOOD AND BEVERAGE AGGREGATE BY THE AGRICULTURE AGGREGATE, 1966

Purchases from Agriculture			Sales to Agriculture	
$ Million	% of Total Inputs From Agriculture	Sector	$ Million	% of Total Outputs to Agriculture
1485.7	54	Meat and poultry processors	4.5	-
714.9	57	Dairy factories	0.0	-
0.8	1	Processed cheese	0.0	-
0.6	-*	Fish products industry	4.6	3
85.2	17	Fruit and vegetable canners	0.0	-
151.3	29	Feed mills	458.8	88
234.0	65	Flour mills	24.5	7
5.3	12	Breakfast cereal manufacturing	0.0	-
0.5	-	Biscuit manufacturing	0.0	-
4.1	-	Bakeries	0.0	-
11.4	4	Confectioneries	0.0	-
17.5	10	Sugar refineries	1.3	-
99.7	80	Vegetable oil mills	10.1	8.1
64.8	10	Miscellaneous food manufacturing	0.0	-
0.0	-	Soft drink manufacturing	0.0	-
37.8	5	Distilleries	0.0	-
28.7	-	Breweries and wineries	0.0	-
273.5	82	Leaf tobacco processing	0.0	-
65.3	8	Tobacco products manufacturing	0.0	-
3281.1		Total	503.8	

* A dash denotes less than 1.0 percent

Source: Derived from input-output table.

the agriculture aggregate for its basic materials, and its development is affected by the supply, quality, and uniformity of farm products as they flow to market. Because numerous by-products of food processing are sold back to the agriculture aggregate in the form of food and feed, the supply, quality, and uniformity of these items have importance for the agriculture

aggregate. The distinct buyer-seller reliance of the food and beverage aggregate on the agriculture aggregate and the distinct seller-buyer relationship in reverse indicate the opportunity for and the importance of internal improvement through industry-wide cooperation and policy integration.

The Fiber Processing Aggregate

The fiber processing aggregate purchased and sold 5.8 billion dollars in goods and services in 1966. From Figure 7, the largest source of input was other intermediate sectors from which over 3.2 billion dollars, or 56 percent, of total inputs were purchased. The second largest source of inputs was from labour and capital utilization. Over 1.3 billion dollars in labour and capital were employed, accounting for 23 percent of total inputs. From Table 3, Appendix G, it is estimated that 86 percent of these factor payments was in the form of wages and salaries, with 12 percent in the form of capital charges (depreciation and costs).

On the output or sales side, Figure 7 indicates that 48 percent or 2.8 billion dollars, of all sales moved directly to final private consumers or to government or business purchasers. Twenty-one percent of all output was sold within the fiber industry.

The relationship of inputs to outputs of this aggregate are shown in more detail in Table 2, Appendix G.

The Chemical Processing Aggregate

The chemical processing aggregate purchased and sold over 2 billion dollars in goods and services in 1966. Referring to Figure 8, the largest source of inputs was from the intermediate sectors, from

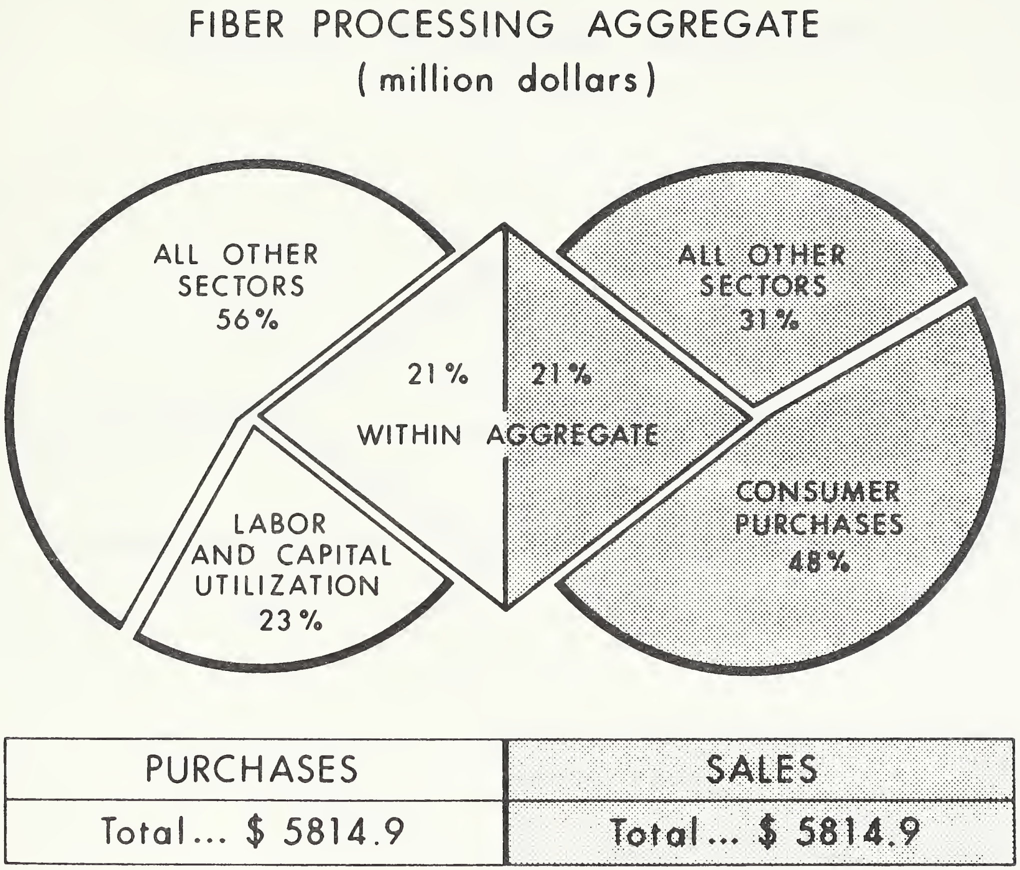


FIGURE 7

PURCHASES BY AND SALES OF THE FIBER PROCESSING AGGREGATE, 1966

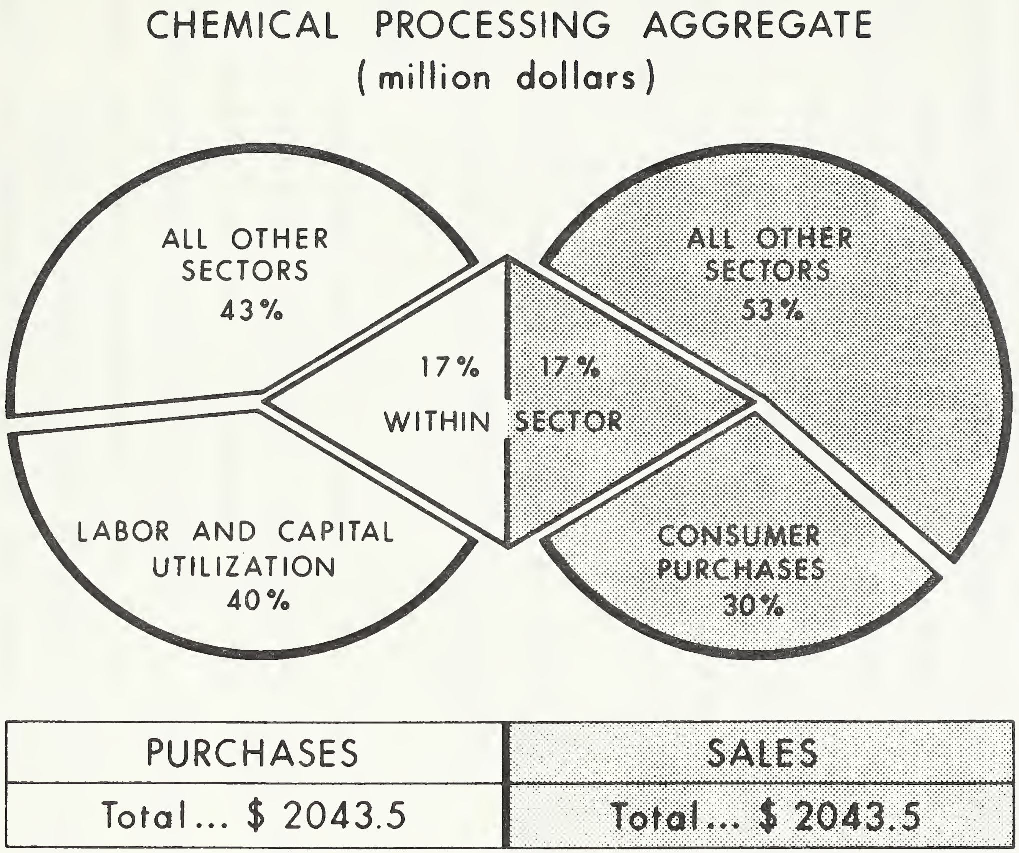


FIGURE 8

PURCHASES BY AND SALES OF THE CHEMICAL PROCESSING AGGREGATE, 1966

which 879 million dollars, or 43 percent, of inputs were obtained. Twelve percent of total inputs came from an agriculture plus food and beverage aggregate, 8 percent from agriculture alone. Labour and capital utilization accounted for 40 percent, or 813 million dollars, of total inputs. This included 453 million for wages and salaries, or 22 percent of total inputs. Intra-aggregate transactions were responsible for the purchase of 351 million dollars, or 17 percent of total inputs.

The main market for the chemical industry is other intermediate sectors, to which it sold over 1 billion dollars in 1966. Consumer purchases contributed 30 percent of total sales, or 614 million dollars. As stated above, intra-aggregate transactions are equal for sales and purchases at 351 million dollars.

Table 3, Appendix G demonstrates in a more exact manner the interrelationships within the chemical processing aggregate.

Summary

Input-output analysis has served to offer a statistical definition of agribusiness. A diagrammatic representation of this definition was presented in the Canadian Agribusiness Flow Chart for 1966. This presentation enabled a comprehensive evaluation of interaction, among selected agribusiness aggregates and the rest of the economy.

Chapter Six presents a further evaluation of the agribusiness system of the Canadian economy using the input-output approach. Emphasis is on the relationship between direct and indirect (secondary) effects of specific agribusiness sectors.

CHAPTER VI

DIRECT AND INDIRECT AGRIBUSINESS RELATIONSHIPS

Methodology

The purpose of Chapter Six is to indicate additional uses of input-output methodology in analyzing, not only direct or primary agribusiness relationships, but also certain indirect or secondary effects on the economy. Chapter Six is based on an understanding of the varied effects demonstrated by the Leontief matrix. The Leontief matrix represents both the direct and indirect requirements of the various sectors of the economy to produce one dollar of product in terms of purchases by the final consumer. The analogy used by Davis and Goldberg to explain this procedure is:

> ...just as a stone thrown in a pool makes a ripple in ever-widening circles, so do the actions of each industry affect other areas of the economy. This analogy holds even to the point that when the "ripples" hit the "shore line" they bounce back against the original ripples, forming an intertwining effect [Davis and Goldberg, 1957, p.62].

This ripple of interaction illustrates the direct and indirect effects of activity in one sector of the economy upon other sectors.

The data in the matrix can be explained by considering first all "on diagonal" elements, then all "off diagonal" elements. The "on diagonal" elements (where i=j for columns and rows) represent requirements of a specific sector to produce one dollar of goods and services for the consumer from that sector. These values include the direct requirements of that sector in the form of intrasector transactions for satisfying one dollar of final demand and the indirect requirements of such sector from other sectors for satisfying such final demand. The

"off diagonal" elements show the direct requirements of any given sector from all other sectors for producing one dollar of final demand and the indirect requirements of such sector from other sectors for satisfying such demand.

Because of the interdependence of sectors, a change in any one sector will cause a change in many others. Using the agriculture sector as an example, the following relationships are observed when final demand for agricultural products increases by one dollar. From the direct input coefficient table, a one dollar increase in agriculture requires a .049 dollar[1] increase in the use of petroleum products. Therefore, petroleum products must increase output by .049 dollars to meet final demand.

If petroleum is to increase output by .049 dollars, an increase of .049 x .583[2] of fuel minerals is required. A third round effect occurs because fuel minerals require .015 x .583[3] dollars of inputs from the all other machinery and equipment sector to increase output by .015 dollars to satisfy the increased final demand. In addition, there would be fourth, fifth, tenth, and ad infinitum round effects, each of decreasing value. This would occur, not only with one, but with all input sectors into the increased production of the initial sector, in this case agriculture. The Leontief matrix provides the final results of these ad infinitum round effects. Unlike the direct input coefficient matrix, all elements have values, thus illustrating that each industry in the economy

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[1] Column 1, Row 68, input-output table.

[2] Column 68, Row 4, input-output table. For the petroleum industry, .583 dollars is the required input per dollar increase of output, but only a .049 dollar increase is required to satisfy final demand.

[3] Column 4, Row 54, input-output table. (The comment in footnote 2 also prevails here).

is connected with every other, either directly, indirectly, or both.

Evaluation of Canadian Agribusiness Relationships

Having viewed the derivation and context of the input-output tables for Canada in 1966, an examination of some of the uses to which they may be put is attempted. Table 14 of Chapter Five related direct sales to final demand as a percent of total sales. To demonstrate the relative importance of direct and indirect effects, percent direct and indirect sales to final demand are presented in Table 19. The term "direct sales" refers to the figures in input-output table, Column 93, entitled Final Demand. They are the end-product items that move directly to consumers without further processing. "Indirect sales" refer to items for which additional processing is essential to support the activities generated by consumers. Intrasector transactions are included as part of indirect sales because values are expressed in terms of gross output.

Of the inputs required to satisfy consumer demand, 36 percent were direct and 64 percent indirect for the Canadian economy as a whole in 1966. This relationship varies widely among specific sectors of the economy. The range goes from 100 percent[4] direct to 100 percent indirect. For every dollar of increased consumer consumption of agriculture products, 7.5 cents are direct sales, 92.5 cents are indirect. Compare this with biscuit manufacturing, which requires 80.1 cents as direct sales and 19.9 cents as indirect sales for every dollar of consumer consumption in the biscuit manufacturing industry.

Regarding the ad infinitum round effects discussed under

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[4] The same reasoning for not seriously accepting direct effects over 100 percent applies as explained in relation to Table 14, Chapter Five.

Table 19

GROSS OUTPUT OF EACH PROCESSING SECTOR REQUIRED IN THE CANADIAN ECONOMY TO SATISFY THE DIRECT PURCHASES OF FINAL CONSUMERS FROM EACH SECTOR, 1966

	Sector	$ Million	Direct (% of Total)	Indirect (% of Total)
1.	Agriculture	5879.9	7.5	92.5
2.	Forestry, hunting, and fishing	1528.6	0.0	100.0
3.	Iron, base metal, uranium	1416.4	0.1	99.9
4.	Fuel minerals	1200.0	1.5	98.5
5.	Nonmetal mining	523.9	0.2	99.8
6.	Meat and poultry processors	2732.2	68.1	31.9
7.	Dairy factories	1243.7	70.9	29.1
8.	Processed cheese	74.7	81.5	18.5
9.	Fish products industry	180.0	72.2	27.8
10.	Fruit and vegetable canners	514.6	87.9	12.1
11.	Feed mills	523.7	0.4	99.6
12.	Flour mills	362.2	16.9	83.1
13.	Breakfast cereal manufacturing	46.0	85.2	14.8
14.	Biscuit manufacturing	107.9	80.1	19.9
15.	Bakeries	766.0	88.5	11.5
16.	Confectioneries	322.4	104.3	0.0
17.	Sugar refineries	174.3	89.0	11.0
18.	Vegetable oil mills	123.9	10.5	89.5
19.	Miscellaneous food manufacturing	653.7	76.4	23.6
20.	Soft drink manufacturing	434.6	76.9	23.1
21.	Distilleries	735.7	67.8	32.2
22.	Breweries and wineries	851.1	93.7	6.3
23.	Leaf tobacco processing	333.0	7.1	92.9
24.	Tobacco products manufacturing	825.9	101.3	0.0
25.	Rubber products	613.0	39.5	60.5
26.	Leather tanneries	58.1	1.0	99.0
27.	Shoe and leather manufacturing	304.9	97.9	2.1
28.	Cotton yarn and cloth	476.9	1.2	98.8
29.	Wool yarn and cloth	35.2	9.6	90.4
30.	Synthetic textile mills	491.0	10.9	89.1
31.	Other textiles	546.3	21.0	79.0
32.	Other knitting mills	26.8	481.5	0.0
33.	Clothing industry	2323.2	96.2	3.8
34.	Wood industry	1666.7	3.5	96.5
35.	Furniture manufacturing	613.4	101.3	0.0
36.	Pulp and paper mills	2462.4	5.6	94.4
37.	Asphalt roofing	58.9	13.3	86.7
38.	Paper containers	818.6	0.3	99.7
39.	Printing and publishing	1006.9	18.9	81.1

continued

Table 19 (continued)

Sector	$ Million	Direct (% of Total)	Indirect (% of Total)
40. Iron and steel mills	997.2	9.8	91.2
41. Steel pipe and tube mills	198.6	21.5	78.5
42. Iron founderies	156.8	21.2	78.8
43. Smelting and refining	738.4	9.0	91.0
44. Aluminum processing	175.6	13.1	86.9
45. Copper processing	251.5	10.6	89.4
46. Metal processing	91.8	56.8	43.2
47. Boiler and plate metal	81.9	45.2	54.8
48. Fabricated and structural metal	162.1	63.4	36.6
49. Ornamental and architectural metal	257.8	40.2	59.8
50. Metal stamping	286.4	11.8	88.2
51. Wire and wire products	402.3	1.9	98.1
52. Hardware and cutlery	127.3	52.0	48.0
53. Other metal industries	141.8	37.7	62.3
54. All other machinery and equipment	1268.5	82.9	17.1
55. Refrigerator and store machinery	382.3	60.6	39.4
56. Aircraft and parts	700.0	47.6	52.4
57. Motor vehicles manufacturing	2369.1	93.7	6.3
58. Vehicle parts manufacturing	772.0	15.2	84.8
59. Other transportation equipment	489.8	85.0	15.0
60. Manufacturing electrical appliances	501.3	84.5	15.5
61. Communications and wire manufacturing	814.1	52.8	47.2
62. Electrical industrial equipment	490.4	72.4	27.6
63. Other electrical products manufacturing	631.6	61.5	38.5
64. Cement and lime	180.8	14.6	85.4
65. Concrete and gypsum	414.7	15.8	84.2
66. Clay and stone	343.5	22.4	77.6
67. Glass and glass products manufacturing	301.2	22.8	77.2
68. Petroleum products industry	1757.2	38.4	61.6
69. Chemicals industry	1140.8	12.1	87.9
70. Mixed fertilizer manufacturing	121.9	4.3	95.7
71. Pharmaceuticals	312.5	93.3	6.7
72. Paint and varnish	230.7	6.7	93.3
73. Soaps and cleaners	237.6	68.6	31.4
74. Miscellaneous manufacturing	1149.1	48.9	51.1
75. Construction	9697.3	84.5	15.5
76. Wholesale and retail trade	9910.6	66.8	33.2
77. Transportation and storage	5284.6	46.8	53.2
78. Communications	1593.1	43.0	57.0
79. Utilities	2407.1	42.8	57.2
80. Finance	7917.8	66.7	33.3

continued

Table 19 (continued)

Sector	$ Million	Direct (% of Total)	Indirect (% of Total)
81. Health and education	803.0	100.0	0.0
82. Business services	1079.0	16.9	83.1
83. Hotels	1388.6	50.1	49.9
84. Restaurants	1761.2	75.7	24.3
85. Other services	1930.8	71.6	28.4
86. Office supplies	499.6	0.0	100.0
87. Advertising and travel	2085.0	0.0	100.0
88. Operating supplies	2597.4	0.0	100.0
89. Commodity taxes	2851.4	86.7	13.3
90. Government services	2460.5	6.2	93.8
91. Wages and salaries	28848.8	12.1	87.9
92. Net income, unincorporated	5320.4	0.0	100.0
93. Surplus	15363.0	5.1	94.9
Total	155533.4	36.4	63.6

Source: Derived from input-output tables.

methodology, Table 20 reviews first and second round effects of selected sectors as derived from input-output tables. From this table, the dollar amounts that industries purchase from any given sector may be determined by reading down the columns. In addition, it is possible from the same table to ascertain the major markets of each of the sectors by reading across the rows.

Table 20 lists the major purchasers from agriculture. The markets of these major purchasers from agriculture, or the derived demand for agriculture, are further depicted. The food and beverage sectors purchased 3.3 billion dollars from agriculture in 1966. In turn, they sold 578 million dollars to restaurants and 504 million dollars to agriculture. The fiber processing sectors purchased 30 million dollars from

Table 20

MAJOR INDUSTRIES THAT PROCURE DIRECTLY FROM AGRICULTURE AND MAJOR INDUSTRIES THAT PROCURE DIRECTLY FROM THE BUYERS OF AGRICULTURE, 1966

Buyers From Agriculture	Amount of Purchases ($ thousands)	Markets of the Buyers of Agriculture	Amount of Purchases ($ thousands)
			From Food and Beverages
Food and beverage processing aggregate	3,281,057	Restaurants	578,042
		Leather tanneries	24,444
		Hotels	91,946
		Soaps and cleaners	29,339
		Agriculture	503,766
			From Fiber
Fiber processing aggregate	30,115	Motor vehicle manufacturing	61,370
		Construction	60,831
		Agriculture	27,318
			From Chemical
Chemical processing aggregate	1,077	Agriculture	191,678
		Iron, base metal, and uranium	164,360
		Rubber products	85,514
		Synthetic textile mills	43,682
		Pulp and paper mills	67,772
		Petroleum products	60,656
		Miscellaneous manufacturing	110,830

Source: Derived from input-output tables.

agriculture and, in turn, sold 61 million dollars to both motor vehicle manufacturing and construction. The chemical processing sectors purchased one million dollars from agriculture, but sold 192 million dollars to agriculture and 164 million dollars to iron, base metal, and uranium.

By this approach it is not possible to determine the magnitude of the effects of this derived or indirect demand instituted by the principal markets of the direct buyers from agriculture. Such an analysis is possible using the Leontief inverse of the input-output tables.

Table 21 depicts the direct and indirect markets of agriculture. It presents the same values as the Leontief table multiplied by one million. These values indicate the direct and indirect inputs required from selected industries for each million dollars of final demand produced by selected industrial aggregates. Because indirect as well as direct requirements are shown in Table 21, it is possible to analyze purchasers from agriculture. Certain derived demand markets, such as tobacco manufacturers and restaurants, are more important to agriculture per dollar of their output than appears from Table 20. Table 21 indicates, not only the importance of the requirements of other sectors of the economy with respect to agriculture, but also the relative importance of agriculture as a direct and indirect supplier per one million dollars of final demand of selected sectors. Even though agriculture may be important to an industry sector per dollar of its final demand, the total final demand of that sector will determine its overall importance as a market to agriculture.

By increasing the final demand for food and beverages by one million dollars, the demand for agriculture products will increase by

Table 21

DIRECT AND INDIRECT REQUIREMENTS FROM SELECTED INDUSTRIES PER MILLION DOLLARS OF FINAL DEMAND FROM THE MAJOR DIRECT AND INDIRECT BUYERS FROM AGRICULTURE, 1966

Direct and Indirect Buyers From Agriculture	Direct and Indirect Dollar Inputs from Industries Listed Below for Each Million Dollars of Final Demand of Industries Named in the Column Opposite	
		($ thousands)
Food and beverage processing aggregates	Agriculture	394,018
	Wholesale and retail trade	178,739
	Transportation and storage	141,128
	Paper containers	65,294
	Motor vehicle manufacturing	62,219
	Petroleum products industry	52,304
Fiber processing aggregate	Wholesale and retail trade	170,503
	Agriculture	124,507
	Construction	87,196
	Paper containers	28,300
Chemical processing aggregate	Wholesale and retail trade	169,408
	Paper containers	59,245
	Petroleum products industry	57,801
	Agriculture	31,268
Restaurants	Agriculture	240,686
	Meat and poultry processors	147,773
	Transportation and storage	89,791
	Dairy factories	84,705
	Construction	82,793

Source: Derived from the Leontief inverse of the input-output table.

394 thousand dollars, for transportation and storage, by 141 thousand dollars, for petroleum products, by 52 thousand dollars. A one million dollar increase in final demand for the fiber processing aggregate will cause a 124 thousand dollar increase for agricultural products and a 59 thousand dollar increase in demand for paper containers. An increase of one million dollars in final demand for the chemical processing aggregate results in an increase in demand of 59 thousand dollars for paper containers and 58 thousand dollars for petroleum products. A one million dollar increase in final demand for restaurants creates a 241 thousand dollar increase in demand for agricultural products, a 148 thousand dollar increase for meat and poultry processors, and a 90 thousand dollar increase for transportation and storage. These are the direct and indirect increases in output from other sectors in order to sustain a one million dollar increase in the final demand of any other sector or sectors.

Detailed Analysis of Selected Sectors

Chapter Six to this point has examined the use of input-output economics in determining the general requirements of agribusiness and other sectors under certain conditions. To expand on the use of input-output analysis, the remainder of the chapter evaluates three specific sectors--agriculture, meat and poultry processors, and mixed fertilizer--by means of this technique.

The input-output structures of the sectors are presented in Tables 22 to 24. Columns 1 and 2 represent sales and purchases undertaken by the sector to or from the rest of the economy. Columns 3,4,and 5 give the input coefficients of the industries in 1966, or the input

Table 22

INPUT-OUTPUT STRUCTURE OF THE CANADIAN AGRICULTURE INDUSTRY, 1966

	$ Million		Input Coefficients		
Sector	Sales	Purchases	Direct	Indirect	Direct and Indirect
Agriculture	286.6	286.6	0.049	1.104	1.153
Forestry, hunting, and fishing	2.2	20.9	0.004	0.019	0.022
Fuel minerals	0.0	7.3	0.001	0.060	0.061
Nonmetal mining	0.0	0.4	0.0	0.010	0.010
Meat and poultry processors	1485.7	4.5	0.0	0.024	0.025
Dairy factories	714.9	0.0	0.0	0.012	0.012
Processed cheese	0.8	0.0	0.0	0.001	0.001
Fish products	0.6	4.6	0.001	0.004	0.005
Fruit and vegetable canners	85.2	0.0	0.0	0.007	0.007
Feed mills	151.3	458.8	0.078	0.020	0.098
Flour mills	234.0	24.5	0.004	0.007	0.011
Breakfast cereal	5.3	0.0	0.0	0.0	0.0
Biscuit	0.5	0.0	0.0	0.001	0.001
Bakeries	4.1	0.0	0.0	0.006	0.006
Confectioneries	11.4	0.0	0.0	0.003	0.003
Sugar refineries	17.5	1.3	0.0	0.004	0.004
Vegetable oil mills	99.7	10.1	0.002	0.012	0.014
Miscellaneous food	64.8	0.0	0.0	0.012	0.012
Distilleries	37.8	0.0	0.0	0.003	0.003
Breweries and wineries	28.7	0.0	0.0	0.004	0.004
Leaf tobacco	273.5	0.0	0.0	0.001	0.001
Tobacco products	65.3	0.0	0.0	0.003	0.003
Rubber products	0.0	12.6	0.002	0.016	0.019
Wool yarn and cloth	1.5	0.0	0.0	0.004	0.004
Other textiles	0.0	26.6	0.005	0.013	0.018
Clothing industry	28.7	0.8	0.0	0.011	0.011
Wood industry	0.0	10.8	0.002	0.008	0.020
Pulp and paper mills	0.2	0.0	0.0	0.026	0.026
Paper containers	0.1	5.1	0.001	0.018	0.018
Wire and products	0.0	11.3	0.002	0.013	0.015
All other machinery and equipment	0.0	70.4	0.012	0.092	0.104
Refrigerator and store	0.0	0.3	0.0	0.006	0.006
Aircraft and parts	0.0	1.9	0.0	0.022	0.023
Motor vehicles	0.0	442.9	0.075	0.046	0.122
Vehicle parts	0.0	137.4	0.023	0.080	0.102
Cement and lime	0.0	0.2	0.0	0.002	0.002
Clay and stone	0.0	0.2	0.0	0.007	0.007
Petroleum products	0.0	290.4	0.049	0.034	0.084
Chemical industry	0.3	73.6	0.013	0.047	0.060
Mixed fertilizer	0.0	90.7	0.015	0.011	0.026

continued

Table 22 (continued)

Sector	$ Million Sales	Purchases	Input Coefficients Direct	Indirect	Direct and Indirect
Pharmaceuticals	0.8	0.0	0.0	0.006	0.006
Miscellaneous manufacturing	0.2	0.4	0.0	0.022	0.023
Construction	12.1	110.2	0.019	0.110	0.128
Wholesale and retail trade	293.7	199.0	0.034	0.144	0.178
Transportation and storage	0.9	141.0	0.024	0.099	0.123
Communications	0.0	19.6	0.003	0.025	0.029
Utilities	0.0	50.8	0.001	0.038	0.047
Finance	0.0	177.7	0.030	0.102	0.132
Business services	0.0	7.5	0.001	0.018	0.020
Hotels	17.8	2.1	0.0	0.020	0.020
Restaurants	74.9	0.0	0.0	0.021	0.021
Other services	1.7	4.7	0.001	0.033	0.034
Office supplies	0.0	9.4	0.002	0.010	0.012
Operating supplies	19.1	200.2	0.034	0.064	0.098
Commodity taxes (net exports)*	1564.2	40.3	0.007	0.048	0.055
Subsidies and government services (re-exports)	0.3	216.5	0.037	0.042	0.079
Wages and salaries (imports)	296.7	450.4	0.077	0.602	0.679
Net income unincorporated (inventory)	149.6	1301.5	0.221	0.100	0.321
Surplus (final demand)	440.8	954.0	0.162	0.337	0.499
Total**	5879.9	5879.9	1.000	4.028	5.028

* Titles in parenthesis refer only to purchases for respective rows.

**Summations not equal to totals due to rounding.

Source: Derived from input-output tables.

structures of the industries.[5]

The direct coefficients calculated from the Canadian interindustry flow matrix (in current values) presents the technical structure of agriculture in 1966. The manipulated technical input matrix[6] determines the direct plus indirect input requirements for the agriculture industry in 1966. The difference between the direct plus indirect and the direct results in indirect input requirements, which in many cases are much greater than the direct coefficients. All input coefficients presented in Tables 22 to 24 represent the dollar input required from each sector to increase total sector output by one dollar.[7]

Total value of intersector trade found in the agriculture sector in 1966 was 5879.9 million dollars.[8] (See Table 22). Column 3 presents the technical input structure which was the basis of almost 6 billion dollars of production in the agriculture sector in 1966. For one dollar of output, intra-agriculture transactions accounted for only 4.9 cents. The expenditure on wages and salaries of 7.7 cents and depreciation (most of net income, unincorporated) of 22 cents per dollar of output were important. The direct coefficients represent agriculture standing alone with a buyer-seller relationship with the rest of the economy.

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[5] Identity matrix minus technical input coefficient matrix inverted.

[6] Input coefficient taken directly from Appendix K, Tables 2 to 4.

[7] Input coefficients can be compared to a one dollar increase in output or any other value. Multiples of 10 are usually used to simplify the presentation of the results.

[8] This figure does not coincide with Canadian farm cash receipts for 1966 of 4,273.6 million dollars. The input-output figures include all relationships between agriculture and the Canadian economy. The farm cash receipt figure involves only reported sales by farmers for 1966. This excludes a large portion of direct farm sales to consumers and many intra-agriculture flows.

Table 23

INPUT-OUTPUT STRUCTURE OF THE CANADIAN MEAT AND POULTRY PROCESSING INDUSTRY, 1966

Sector	$ Million Sales	$ Million Purchases	Input Coefficients Direct	Input Coefficients Indirect	Input Coefficients Direct and Indirect
Agriculture	4.5	1485.7	0.544	0.240	0.784
Fuel minerals	0.0	2.1	0.001	0.050	0.051
Nonmetal mining	0.0	2.0	0.001	0.009	0.009
Meat and poultry processors	452.4	452.4	0.166	1.055	1.220
Dairy factories	1.1	0.4	0.0	0.012	0.012
Processed cheese	0.0	2.1	0.001	0.001	0.002
Fish products industry	2.7	7.4	0.003	0.005	0.007
Fruit and vegetable canners	20.5	0.3	0.0	0.006	0.006
Feed mills	25.7	0.8	0.0	0.067	0.068
Flour mills	0.8	1.3	0.0	0.008	0.009
Breakfast cereal	0.1	0.0	0.0	0.0	0.0
Biscuit	5.9	0.0	0.0	0.001	0.001
Bakeries	28.6	0.0	0.0	0.006	0.006
Confectioneries	0.4	0.0	0.0	0.002	0.002
Sugar refineries	0.0	1.1	0.0	0.004	0.004
Vegetable oil mills	0.2	37.4	0.014	0.013	0.027
Miscellaneous food manufacturing	13.0	8.3	0.003	0.012	0.015
Soft drink manufacturing	0.5	0.0	0.0	0.002	0.002
Distilleries	2.4	0.0	0.0	0.003	0.003
Breweries and wineries	0.5	0.0	0.0	0.004	0.004
Leaf tobacco	3.1	0.0	0.0	0.001	0.001
Tobacco products	2.4	0.0	0.0	0.002	0.002
Leather tanneries	24.0	0.0	0.0	0.001	0.001
Cotton yarn and cloth	0.0	0.3	0.0	0.010	0.010
Synthetic textile mills	0.0	0.3	0.0	0.009	0.009
Other textiles	0.0	2.0	0.001	0.015	0.016
Other knitting mills	0.0	0.3	0.0	0.005	0.005
Wood industry	0.0	3.6	0.001	0.019	0.020
Pulp and paper mills	0.0	4.2	0.002	0.033	0.035
Paper containers	0.0	42.8	0.016	0.021	0.037
Fabricated and structural metal	0.0	13.0	0.005	0.010	0.015
Refrigerator and stove	0.0	0.7	0.006	0.006	0.006
Glass and products	0.0	0.4	0.0	0.005	0.005
Petroleum products	0.0	4.1	0.001	0.065	0.066
Chemicals industry	1.2	9.0	0.003	0.052	0.055
Mixed fertilizer	0.4	0.0	0.0	0.018	0.018
Pharmaceuticals	1.8	0.0	0.0	0.005	0.005
Soaps and cleaners	3.4	0.0	0.0	0.004	0.004
Miscellaneous manufacturing	0.2	2.4	0.001	0.022	0.023

continued

Table 23 (continued)

Sector	$ Million		Input Coefficients		
	Sales	Purchases	Direct	Indirect	Direct and Indirect
Construction	0.0	5.7	0.002	0.113	0.115
Wholesale and retail trade	5.6	53.2	0.019	0.162	0.182
Transportation and storage	0.0	63.4	0.023	0.112	0.135
Communications	0.0	8.1	0.003	0.028	0.031
Utilities	0.0	13.0	0.005	0.043	0.048
Finance	0.0	6.0	0.002	0.114	0.116
Business services	0.0	2.4	0.001	0.019	0.020
Hotels	18.3	1.7	0.001	0.020	0.021
Restaurants	188.0	0.0	0.0	0.022	0.022
Other services	0.0	6.2	0.002	0.033	0.035
Office supplies	0.0	3.4	0.001	0.011	0.012
Advertising and travel	0.0	25.3	0.009	0.043	0.052
Operating supplies	33.1	49.7	0.018	0.086	0.104
Commodity taxes (net exports)*	68.2	2.0	0.001	0.051	0.051
Subsidies and government services (re-exports)	0.9	8.1	0.003	0.063	0.066
Wages and salaries (imports)	-61.8	320.9	0.117	0.643	0.761
Net income, unincorporated (inventory)	23.1	4.9	0.002	0.238	0.239
Surplus (final demand)	1861.0	74.1	0.027	0.427	0.454
Total**	2732.2	2732.2	1.000	4.662	5.662

* Titles in parenthesis refer only to purchases for respective rows.

**Summations not equal to totals due to rounding.

Source: Derived from input-output tables.

Column 4, the indirect input coefficients, evaluates the indirect effects of a one dollar increase in agriculture production on increasing production in the rest of the economy. Total indirect effects are over four times greater for the agriculture sector than its direct effects.

Column 5 demonstrates the results of a one dollar increase in agriculture on the Canadian economy both directly and indirectly. To meet this increase, the combined effect on agriculture is 1.15 dollars, which includes the one dollar increase initially sought. The 15 cents of output is required to supply the increased output generated throughout the economy by the initial one dollar increase in agriculture. A one dollar increase in production of agriculture results in 5.03 dollars of output being generated throughout the Canadian economy.

The meat and poultry processing industry in Canada interacted with the Canadian economy in 1966 through sales and purchases of 2732.2 million dollars. Column 3, Table 23 represents the technical input structure of the meat and poultry processing industry. The direct input coefficients measure the required input per sector to process one dollar of meat and poultry products. Agriculture contributes 54 cents of inputs, while wages and salaries contribute 12 cents per dollar of output. Depreciation (surplus) is a relatively minor expense, requiring only .1 cent per dollar of output.

Column 4, the indirect input coefficients, appraises the indirect effects of a one dollar increase in the output of meat and poultry processing sector on increasing production of the Canadian economy. Total indirect effects are 4.7 times direct effects.

Column 5 demonstrates the total, both direct and indirect, effects of a one dollar increase in the processing of meat and poultry

on the Canadian economy in 1966. Intra-meat and poultry requirements of 1.22 dollars account for the initial increase of one dollar plus a further increase needed to fulfill increased demand by the rest of the economy. The total direct plus indirect effects caused by increasing the output of the meat and poultry sector by one dollar are 5.6 cents or for every dollar increase in meat and poultry processing, the Canadian economy feels a generation of income of 5.6 dollars.

The fertilizer industry in Canada interacted with the Canadian economy through the sale and purchase of 121.9 million dollars in 1966. Column 3 of Table 23 outlines the technical input structure of the Canadian fertilizer industry. For each dollar of output the fertilizer industry required 5.8 cents of input from nonmetal mining and 30 cents as intrasector transactions from itself. Wages and salaries accounted for 15 cents of input per dollar of output.

Column 4, the indirect input coefficients per dollar of output, represents the reaction of the economy's producing sectors to a one dollar increase in fertilizer output. Every dollar increase of fertilizer output increases indirectly the output of the rest of the economy by 4.7 dollars.

Column 5 demonstrates total interindustry interaction per dollar output increase by the fertilizer industry. A one dollar increase in the output of the fertilizer sector generates 5.7 dollars of output throughout the Canadian economy. Fertilizer sector intratransactions result in a 1.13 dollar output in the sector by an initial one dollar increase. However, one dollar of the 1.13 dollars is caused by this initial one dollar increase of output, 13 cents being left for interindustry effects.

Table 24

INPUT-OUTPUT STRUCTURE OF THE CANADIAN FERTILIZER INDUSTRY, 1966

	$ Million		Input Coefficients		
Sector	Sales	Purchases	Direct	Indirect	Direct and Indirect
Agriculture	90.7	0.0	0.0	0.063	0.063
Fuel oils	0.0	0.1	0.001	0.045	0.046
Nonmetal mining	0.0	7.1	0.058	0.038	0.096
Meat and poultry processors	0.0	0.4	0.003	0.023	0.027
Other textiles	0.0	0.1	0.001	0.011	0.012
Paper containers	0.0	5.3	0.044	0.044	0.088
Iron and steel mills	0.4	0.0	0.0	0.038	0.038
Refrigerator and store machinery	0.0	0.1	0.001	0.007	0.007
Clay and stone	0.0	0.3	0.003	0.009	0.011
Glass and products	0.1	0.0	0.0	0.006	0.006
Petroleum products	0.0	0.4	0.003	0.051	0.054
Chemicals industry	1.1	20.9	0.171	0.164	0.335
Mixed fertilizer	36.2	36.2	0.297	1.128	1.425
Soaps and cleaners	0.1	0.0	0.0	0.005	0.005
Miscellaneous manufacturing	0.0	0.1	0.001	0.031	0.032
Construction	0.0	2.1	0.018	0.121	0.139
Wholesale and retail trade	0.1	1.5	0.013	0.167	0.179
Transportation and storage	0.0	9.4	0.077	0.136	0.214
Communications	0.0	0.7	0.006	0.034	0.039
Utilities	0.0	1.0	0.008	0.056	0.064
Finance	0.0	1.5	0.012	0.110	0.122
Business services	0.0	0.1	0.001	0.024	0.025
Hotels	0.1	0.1	0.001	0.030	0.031
Restaurants	0.1	0.0	0.0	0.030	0.030
Other services	0.0	0.3	0.003	0.040	0.043
Office supplies	0.0	0.2	0.002	0.012	0.014
Advertising and travel	0.0	3.1	0.026	0.062	0.088
Operating supplies	0.0	5.6	0.046	0.096	0.142
Net exports commodity taxes	114.4	0.1	0.001	0.052	0.053
Subsidies and government services (re-exports)*	0.0	1.0	0.009	0.047	0.056
Wages and salaries (imports)	-21.2	18.0	0.148	0.765	0.913
Net income, unincorporated (inventory)	-105.5	0.0	0.0	0.087	0.087
Surplus (final demand)	5.3	6.0	0.049	0.451	0.500
Total	121.9	121.9	1.000	4.689	5.689

* Titles in parentheses refer only to purchases for respective rows.
** Summations not equal to totals due to rounding.

Source: Derived from input-output tables.

Summary

Chapter Six has explained many of the interrelationships that exist within the agribusiness subsystem and among components of this subsystem and the Canadian economy. By use of the input-output technique as expressed in Chapter Six, quantification of the reciprocal and rebounding movement of resources, goods, and services throughout the component phases of agribusiness and in relation to the Canadian economy has been possible. Chapter Seven quantifies the value of the agribusiness subsystem to the Canadian economy. Input-output techniques are used once again to specify the role of agribusiness.

CHAPTER VII

ECONOMIC INFLUENCE OF CANADIAN AGRIBUSINESS

Input-output analysis provides a means by which the economic or dollar value of a particular sector to the national economy may be calculated. This technique is referred to as multiplier analysis. Further analysis of the dollar value of sectors is facilitated by reference to Gross Domestic Product for selected aggregated sectors of the economy. A comparison is made between figures calculated by input-output and by national accounting techniques.

Multiplier Analysis

Derivation of output multipliers is best explained mathematically. Equation 6 of Appendix C (Equation 1 below) represents the Leontief inverse, or the matrix of interdependence, where the elements Aij are the resulting interdependence coefficients.

$$\begin{array}{l} X_1 = A_{11}Y_1 + A_{12}Y_2 + \dots A_{1j}Y_j + \dots A_{1n}Y_n \\ X_2 = A_{21}Y_1 + A_{22}Y_2 + \dots A_{2j}Y_j + \dots A_{2n}Y_n \\ \cdot \quad\quad \cdot \quad\quad \cdot \quad\quad\quad \cdot \quad\quad\quad \cdot \\ \cdot \quad\quad \cdot \quad\quad \cdot \quad\quad\quad \cdot \quad\quad\quad \cdot \\ X_i = A_{i1}Y_1 + A_{i2}Y_2 + \dots A_{ij}Y_j + \dots A_{in}Y_n \\ \cdot \quad\quad \cdot \quad\quad \cdot \quad\quad\quad \cdot \quad\quad\quad \cdot \\ X_n = A_{n1}Y_1 + A_{n2}Y_2 + \dots A_{nj}Y_j + \dots A_{nn}Y_n \end{array} \tag{1}$$

If $A_{1.1}$ shows the output required of industry 1 to deliver one dollars worth of products of industry 1 to final demand, $A_{2.1}$ shows the output required of industry 2 to deliver one dollars worth of products of

industry 1 to final demand, and $A_{i.1}$ shows the output required of industry i to deliver one dollars worth of products of industry 1 to final demand, then the sum $A_{1.1} + A_{2.1} + \ldots + A_{i.1} + \ldots + A_{n.1}$ shows the total output required of all sectors to deliver one dollars worth of products of industry 1 to final demand. Corresponding interpretations may be made for each column of the interdependency matrix.

These column totals are termed output multipliers. Each output multiplier expresses the total change in the value of Canada's total gross output (income) induced by a one dollar change in final demand for products of a particular industry. Each Canadian sector may be ranked in order of its relative total output inducing capability per dollar of final demand. Output multiplier weighted by a specified percentage change in final demand for each sector of the economy, have been used by Martin and Carter [Martin and Carter, 1963] in analyzing the California economy. This measure is shown in Equation 2, where $\sum_i^n \Delta X_i$ expresses the total output change in the economy associated with a specified final demand change (Y_j) for sector j; $\sum_i^n \Delta A_{ij}$ is the output multiplier for sector j.

$$\sum_i^n \Delta X_i = \sum_i^n A_{ij} \Delta Y_j \tag{2}$$

Output multipliers are not the same as the widely discussed "investment multiplier" of Keynesian theory. Both multipliers reflect changes in national (or regional) product resulting from changes in consumption or investment. The investment multiplier implies the adjustment of the economy to a general equilibrium solution of consumption, savings, and investment. Input-output analysis does not present general equilibrium solutions. It is a technical production analysis showing

interdependence among industries. The economic "balance" of income, savings, and investment is not considered, nor are equilibrium conditions implied.

There is an input-output multiplier for each sector of the economy. Each multiplier expresses the aggregate effect on national production (excluding production of sectors not considered endogenous to the system) caused by a specified change in a particular final demand, given the technical production requirements of each industry. Because output of certain sectors is considered to be exogenously determined, solutions are partial rather than complete. For example, further consumption by households, and its multiplying effects on output, in response to increased income generated by increased production generated by an original increase in household demand is not reflected. These income effects are critical for Keynesian multipliers. Keynesian multipliers do not, however, specify particular interrelationships between specific industries.

Table 25 presents an analysis of the twenty greatest output multipliers from Appendix H. Unweighted multipliers range from 6.16 for sugar refineries to 3.01 for business services. Of the 20 highest output multiplying sectors of the economy, 12 are classified as agribusiness industries according to the definition given in Chapter Five. Seven of the highest ten are classified to the agribusiness system.

Output multipliers for each sector listed in Table 24 are weighted with 10 percent[1] of their respective final demands[2] and are

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[1] A 10 percent change in final demand was selected arbitrarily within the realm of possible short run demand changes that may be handled within the framework of a static input-output model. The change may be considered either positive or negative.

[2] Caution must be exercised when using output multipliers for sectors which have no significant final demand.

RANKING OF TOP 20 GOODS AND SERVICES PRODUCING SECTOR MULTIPLIERS IN DESCENDING ORDER

Sector No.	Title	Output Multiplier[1]	Rank #1[2]	1966 Final Demand ($ million)	Weighted Output Multipliers[3] ($ million)	Rank #2[4]
17	Sugar refineries	6.160569	1	155.1	95.550	38
68	Petroleum products industry	5.982771	2	674.2	403.358	15
45	Copper processing	5.979566	3	26.8	16.025	67
18	Vegetable oil mills	5.867021	4	13.0	7.627	74
43	Smelting and refining	5.797845	5	66.2	38.382	53
23	Leaf tobacco processing	5.796937	6	23.7	13.739	70
19	Miscellaneous food mfg.	5.749972	7	499.2	287.039	19
11	Feed mills	5.691627	8	1.9	1.081	80
70	Mixed fertilizer mfg.	5.688644	9	5.3	3.015	79
6	Meat & poultry processing	5.661729	10	1861.0	1053.648	6
24	Tobacco products mfg.	5.657228	11	836.2	473.057	13
41	Steel pipe and tube mills	5.640128	12	42.7	24.083	63
79	Utilities	5.633550	13	1029.6	580.030	9
12	Flour mills	5.618834	14	61.4	34.500	55
21	Distilleries	5.608187	15	498.9	279.792	21
46	Metal processing	5.576882	16	52.2	29.111	59
44	Aluminium processing	5.527551	17	22.9	12.658	71
8	Processed cheese	5.501540	18	60.9	33.504	56
7	Dairy factories	5.489161	19	881.5	483.870	11
64	Cement and lime	5.470500	20	26.5	14.497	69

[1] Top 20 output multipliers of Appendix H.

[2] Ranking of output multipliers in Column #1.

[3] Output multipliers (Column #1) for each sector are multiplied by an amount equal to 10 percent of the 1966 final demand shown in Column 3.

[4] Ranking of weighted output multipliers of all 85 sectors.

Source: Appendix H.

illustrated and ranked in Columns 4 and 5 respectively. Total final demand for the Canadian economy in 1966 was 56,677.9 million dollars.[3]

All sectors with output multipliers in the top twenty fall much further down in the ranking of weighted output multipliers, with the exception of meat and poultry processing, which rises from tenth to sixth. The top ten weighted output multipliers belong to sectors: construction, wholesale and retail trade, finance, motor vehicle manufacturing, transportation and storage, meat and poultry processing, clothing manufacturing, restaurants, utilities, and other services in descending order respectively. Of these ten, seven are service sectors; only three are goods producing sectors. Because one goal of the service producing sectors is to provide services to the goods producing sectors, a ranking of the top ten output multiplier sectors including only goods producers is appropriate. This ranking includes 1) motor vehicle manufacturing, 2) meat and poultry processors, 3) clothing manufacturers, 4) dairy factories, 5) all other machinery and equipment, 6) tobacco products manufacturers, 7) breweries and wineries, 8) petroleum products, 9) bakeries, and 10) miscellaneous food manufacturers. Six of these belong to the agribusiness system.

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[3] The sum of the percentage changes in output occurring as a result of a 10 percent change in final demand for both agriculture and other industry is also 10 percent. Although changes in output of, for example, other industries are induced in varying degrees by a 10 percent change in final demand for output of individual sectors, if final demand for each and every sector changes by the same percent, total output for any given sector is changed by that percent also. In other words, if every sector's final demand increases in a fixed proportion, then every input and output in the economy increases proportionally. The new economy is an exact replica of the old one, but on a larger scale.

The meat and poultry sector ranks high in all three classifications because of a high output multiplier and a relatively high final demand. The high output multiplier establishes the role of this sector as an important income generating sector. Meat and poultry processing influences the total income of the economy per dollar of output more than 75 of the 85 sectors quantified. The final demand in 1966 of the meat and poultry processing sector--1,861.0 million dollars--was the seventh greatest in the Canadian economy. The weighted multiplier of the meat and poultry processing sector supports the above statements. Of the initial 20 highest unweighted output multipliers, only 6 remain in the top 20 weighted multipliers. Only one, meat and poultry processing, remains in the top ten. The meat and poultry processing sector has the second highest weighted multiplier of all goods producing sectors, following only motor vehicle manufacturing, which generates only 5.273 dollars of income per dollar of final demand, versus a meat and poultry processing income generation of 5.662 dollars per dollar of output.

Output multipliers of the grain processing sectors; feed mills, flour mills, breakfast cereal manufacturers, bakeries, and biscuit manufacturers rank eighth, fourteenth, twenty-second, forty-ninth and thirty-fourth respectively. Only feed mills ranks higher than meat and poultry processors in contribution towards gross total income due to a specific increase in final demand.

All multipliers were computed under the assumption of fixed input-output (supply) relationships. This procedure was selected to illustrate and analyze prevailing sector interrelationships, rather than to make detailed projections over time. The underlying assumption of

each multiplier is that the structure of the economy does not change markedly as final demand changes. That is, the magnitude of each direct input per unit of output remains the same after the change in final demand. The limitations of this assumption are minimized in a national model where proportionally large imports are impossible. The relationship between domestic inputs and imported inputs per unit of output may change rapidly. If the shift is toward a greater percentage of imports, the multiplicative effects of the change in final demand may be lessened.

Wages and Salaries Generated by Requirements for Products of Canadian Industry, 1966

Wages and salaries are the direct dollar counterpart to employment. Wages and salaries do not account for returns to management through either surplus or net unincorporated income. In the manufacturing industries, most labour, including management, is hired. But in the agricultural and service industries where proprietors may perform much of the labour themselves, wages and salaries may not completely account for this form of self-employment. This form of hired wages and salaries is particularly relevant in that it forms the main base for consumer purchases. Therefore, direct and indirect wage effects are summarized in Table 26 from Appendix J.

Appendix I analyzes five main employment aspects of the sectors of the Canadian economy: 1) direct wages and salaries per dollar output, 1966; 2) direct plus indirect wages and salaries per dollar output, 1966; 3) total wages and salaries, 1966, in million dollars; 4) wage and salary effects of a 10 percent change in final demand, 1966; and 5) percentage change of total wages and salaries resulting from a 10 percent change in

Table 26

WAGES AND SALARIES GENERATED BY REQUIREMENTS FOR PRODUCTS OF CANADIAN GOODS AND SERVICES PRODUCING SECTORS, 1966

Sector	Direct Wages and Salaries per Dollar Output, 1966[1]	Rank[2]	Direct plus Indirect Wages and Salaries per Dollar Output, 1966[3]	Rank[4]	Total 1966 Wages and Salaries ($ Million)[5]	Rank[6]	Wage and Salary Effects of a 10% Change in Final Demand 1966[7]	Rank[8]	Percent Change in Total Wage and Salaries Resulting From a 10% Change in Final Demand, 1966[9]	Rank[10]
Construction	.310266	26	.891452	53	3008.741	2	721.211	1	24.0	28
Wholesale and retail trade	.398262	8	.831696	70	3947.015	1	550.500	2	13.9	41
Finance	.165697	67	.795012	73	1311.972	4	419.774	3	32.0	18
Transportation and storage	.399685	7	.901222	45	2112.174	3	223.124	4	10.6	48
Clothing industry	.323521	25	.918594	24	751.636	5	205.398	5	27.3	23
Motor vehicle manufacturing	.163872	68	.923747	16	388.229	19	205.026	6	52.8	3
Meat and poultry processors	.117430	78	.760569	80	320.854	21	141.542	7	44.1	8
Other services	.354562	14	.777626	76	684.588	7	107.491	8	15.7	38
Restaurants	.296009	30	.783899	75	521.331	10	104.502	9	20.0	33
All other machinery and equipment	.340794	18	.934928	7	432.297	15	98.336	10	22.7	30
Utilities	.178288	64	.895041	51	429.157	16	92.153	11	21.5	32
Breweries and wineries	.223768	54	.888330	56	190.449	33	70.827	12	37.2	12
Tobacco products manufacturing	.172676	66	.828139	71	142.613	38	69.249	13	48.6	5
Dairy factories	.144404	73	.767836	77	179.595	34	67.685	14	37.7	11
Communication	.436895	1	.921417	20	696.017	6	63.135	15	9.0	51
Petroleum products industry	.064404	83	.884005	57	113.171	46	59.600	16	52.7	4
Bakeries	.298921	29	.854576	68	228.973	28	57.932	17	25.3	26
Furniture manufacturing	.330570	21	.910092	39	202.772	30	56.571	18	27.9	22
Hotels	.348524	16	.793265	72	483.960	11	55.227	19	11.4	45
Miscellaneous manufacturing	.325240	24	.911685	38	373.798	20	51.237	20	13.7	40

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[1] Row 91, Table 2, Appendix K.

[2] Ranking of Column 1.

[3] Row 91, Table 3, Appendix K.

[4] Ranking of Column 3.

[5] Row 91, Table 1, Appendix K.

[6] Ranking of Column 5.

[7] Column 3 x 10% of final demand.

[8] Ranking of Column 7.

[9] Column 7 divided by Column 5.

[10] Ranking of Column 9.

Source: Appendix I

final demand, 1966. Each column is then ranked in descending order. Table 26 includes all sectors ranking in the top 20 under the column entitled Wage and Salary Effects of a 10 Percent Change in Final Demand, 1966.

Direct wages and salaries paid per dollar of output range from 44 cents for communications to 4 cents for vegetable oil mills. The top ten in descending order are: communications, aircraft and parts, other transportation equipment, printing and publishing, electrical industrial equipment, business services, transportation and storage, wholesale and retail trade, iron foundaries, and communication and wire manufacturing. Four of the top ten are service industries. No agribusiness sectors are present. None of these top 10 appear in the top 20 as far as output multipliers are concerned. Labour plays a much greater role than interindustry transactions. A sector cannot have a high labour input as well as high interindustry purchases per dollar of output; a trade off exists. Direct plus indirect wages and salaries paid per dollar of output range from 95 cents for aircraft and parts to 43 cents for health and education. These figures include all direct wages and salaries paid by the sector, plus wages and salaries generated throughout the economy in order to fulfill input requirements by the initial sector. The top ten in descending order are: aircraft and parts, other transportation equipment, electrical industrial equipment, fabricated and structural metal, communications and wire manufacturing, vehicle parts manufacturing, all other machinery and equipment, boiler and plate metal, glass and glass products, and manufacturing of electrical appliances. No service industries are among these ten. This is because of the relatively low interdependence among service

sectors and the rest of the economy. Likewise, no agribusiness sectors are present. Four of the top ten under direct plus indirect wages and salaries paid also appeared in the top ten of direct wages and salaries paid.

Total wages and salaries paid in the Canadian economy in 1966 amounted to 28848.8 million dollars. Sectorally, figures ranged from 3947.0 million dollars for the wholesale and retail trade to 5.5 million dollars for vegetable oil mills. The top ten in descending order are: 1) wholesale and retail trade, 3947.0; 2) construction, 3008.7; 3) transportation and storage, 2112.2; 4) finance, 1312.0; 5) clothing industry, 751.6; 6) communications, 696.0; 7) other services, 684.6; 8) pulp and paper mills, 554.9; 9) forestry, hunting, and fishing, 536.8; and 10) restaurants, 521.3. All figures are expressed in millions of dollars.

Seven service industries occur in the top ten. One in the top ten is an agribusiness sector; restaurants. These figures represent the sectors that most significantly affect the total employment situation.

Effects on wages and salaries by a 10 percent change in final demand for each sector are calculated in Column 7 of Table 26. The top 20 sectors are ranked according to their respective values. Two agribusiness sectors are present in the top ten: meat and poultry processors, and restaurants. These figures explain the generation of wages and salaries throughout the economy resulting from a change of 10 percent in final demand for any specific sector. The clothing industry, motor vehicle manufacturing, and meat and poultry processors are the greatest generators of employment wages and salaries among the manufacturing sectors. Service

sectors, which account for six of the top ten, are primarily available to provide services to goods producing sectors. A 10 percent increase in final demand for service sectors without a corresponding increase in final demand for the sectors serviced is impossible under a constant input coefficient assumption, which is the case in input-output analysis. A structural change in the sectors serviced would occur.

Wages and salaries generated, not only by the initial sector, but also by all interacting sectors of the economy are calculated as a percent of the initial wages and salaries paid by the sectors for which a 10 percent change in final demand occurs. Other knitting mills, with a percent change of 148.9, is the highest sector, followed by sugar refineries, 69.8; motor vehicles manufacturing, 52.8; petroleum products industry, 52.7; tobacco products manufacturing, 48.6; miscellaneous food manufacturing, 46.6; processed cheese, 45.6; meat and poultry processors, 44.1; fruit and vegetable corners, 42.9; and distilleries, 41.1. Eight of the top ten belong to the agribusiness system. These eight agribusiness sectors, when confronted by a 10 percent increase in final demand, generate employment wages and salaries throughout the economy to an extent relative to the initial wages and salaries paid by each sector, equalled by only two nonagribusiness sectors of the economy.

A 10 percent change in final demand for all Canadian sectors would affect total Canadian wages and salaries by 14.7 percent. Agribusiness sectors play an important role in contributing to a significant change in wages and salaries generated by a 10 percent change in final demand. Chapter Three, Table 3 depicts the low wages paid agribusiness workers relative to other sectors of the Canadian economy. Consequently,

an equal value of wages and salaries for agribusiness and other sectors would result in a larger employment volume in agribusiness than in other higher salaried sectors.

This analysis does not represent the increase in output required by the resulting increase in wages and salaries. A greater effect by those sectors ranking high in the last two columns of analysis on the total employment wages and salaries would result if a corresponding increase in consumer expenditure were included. This approach is beyond the scope of input-output analysis.

Canadian Gross Domestic Product,[4] 1966

A detailed breakdown of G.D.P. for each sector of the 1966 Canada input-output table is located in Appendix J. This table serves as a basis for Table 27, which presents aggregated results of G.D.P. emphasizing agribusiness. The classification of agribusiness sectors is identical to that proposed in Chapter Five, Table 16. Total G.D.P. of agribusiness in 1966 was 10,515 million dollars. However, total G.D.P. of agribusiness pertaining to the goods producing sectors was only 8353 million dollars. The G.D.P. of goods producing sectors and service producing sectors was 20,107 and 25,163 million dollars respectively. This means that the agribusiness system contributed 46 percent of the Canadian G.D.P. contributed by the goods producing sectors. As a proportion of total goods plus service producing sectors, agribusiness was responsible for 23 percent. In total, agribusiness directly contributed 21 percent of total Canadian G.D.P. in 1966.

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[4] Gross Domestic Product = Value Added - Indirect Taxes. Indirect taxes are included in the input-output classification under government services. For this reason it is not possible to evaluate value added figures from the present input-output table.

Total contribution to agribusiness G.D.P. by the meat and poultry sector is 399.8 million dollars or 3.5 percent. The grain processing sectors (feed mills, grain mills, breakfast cereal manufacturers, biscuit manufacturers, and bakeries) contributed 472.8 million dollars or 4.5 percent. The greatest contribution to agribusiness G.D.P. was by agriculture; 25.7 percent or 2705.8 million dollars. Restaurants with 835.9 million dollars or 8.0 percent of total agribusiness G.D.P.

Chapter Seven has evaluated the contribution of individual sectors to the Canadian economy in 1966 by means of output multipliers, employment generating effects, and Gross Domestic Product. The meat and poultry processing sector stands out in all categories as the agribusiness sector contributing most to the Canadian economy. Few nonagribusiness sectors have such an economic effect on the economy. Seven of the top ten output multipliers belong to agribusiness sectors. Meat and poultry processors, through a 10 percent change in final demand, generate 142 million dollars to employment wages and salaries throughout the economy, ranking seventh in the economy. Relative to initial expenditures on wages and salaries, a 10 percent change in final demand in the meat and poultry sector generates the eighth greatest increase in wages and salaries. Of the five grain processing sectors evaluated by input-output analysis only feed mills with an output multiplier of 5.69 appears to make a valuable contribution to the prosperity of the Canadian economy. No grain processing sectors play a significant role in generating employment in the economy relative to other sectors. Forty-two percent of the Gross Domestic Product contributed to the Canadian economy in 1966 by goods producing sectors came from the agribusiness system.

Table 27

INPUT-OUTPUT GROSS DOMESTIC PRODUCT OF CANADIAN AGRIBUSINESS, 1966

Classification[1]		Gross Domestic Product ($ million)
Agribusiness (including basic agriculture)		
Sector > 50%		6,728.6
25% ≤ Sectors ≤ 50%		1,033.7
5% ≤ Sectors[2] < 25%		2,752.2
Total agribusiness		10,514.5
Total agribusiness pertaining to goods producing sectors		8,353.0
Goods[3] producing sectors		20,106.6
Service[4] producing sectors		25,162.9
Agribusiness percent of total goods and services	23%	
Agribusiness[5] as percent of goods producing sectors	42%	
Total Canada		49,532.2
Agribusiness percent of Total Canada	21%	

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[1] Classification of agribusiness proposed in Chapter Five, Table 14.

[2] Only that proportion of G.D.P. closely related to agribusiness is included, as explained in Chapter Five.

[3] Sectors 1-74 of input-output table.

[4] Sectors 74-85 of input-output table.

[5] Agribusiness sectors from 1-74.

The contribution of agribusiness sectors is felt widely by all sectors of the economy. The meat and poultry processing sector stands out as the most important sector of the agribusiness system and one of the most important sectors of the whole economy in terms of its contribution to the welfare of the Canadian economy in 1966.

Chapter Seven completes the evaluation and appraisal of the Canadian economy emphasizing agribusiness by means of input-output analysis. Chapter Eight takes an objective look at these results and offers some conclusions and recommendations for a healthy and dynamic Canadian economy in the future.

CHAPTER VIII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary and Conclusions

Chapter Eight presents the conclusions and policy recommendations arrived at by this thesis in pursuing the objectives and testing the hypothesis of Chapter One.

Hypothesis one, that conventional national accounting procedures do not consider the interdependence between sectors of the economy can not be rejected. Conventional national accounting procedures and input-output analysis do not yield the same definition of the agribusiness system. Conventional theory builds upon the agriculture sector; and the agribusiness concept used in input-output analysis builds upon the interdependence of the agriculture, food, and beverage sectors with one another and the rest of the economy.

The hypothesis that; the national accounting system has traditionally understated the economic influence of Canadian agriculture, from the preceding analyses can not be rejected. Conventional accounting results concerning the importance of the agribusiness system to the Canadian economy are not synonymous with results stemming from input-output analysis. Input-output analysis appraises economic interdependence among sectors; national accounting techniques document only final economic results. National accounting procedures state that agribusiness, as conventionally defined, was the source of 36 percent of Personal Consumer Expenditures in 1966. Input-output analysis states that agribusiness, as defined by input-output techniques, was the source of 42 percent of Personal Consumer Expenditure in 1966.

Input-output analysis and national accounting procedures conclude that the agribusiness system plays a vital role in the growth of the Canadian economy. Seven of the greatest ten output multipliers of the Canadian economy belong to the agribusiness system. As a result, agribusiness sectors greatly influence potential gross total income of the Canadian economy. Furthermore, the systems approach concludes that the agribusiness system contributed 21 percent of total Canadian Gross Domestic Product in 1966 and over 41 percent of the Gross Domestic Product contributed by the goods producing sectors.

Tradition has placed emphasis on the grain industry in Canada. In recent years the livestock and poultry industry has surpassed the grains industry in terms of farm cash receipts. In 1966 the grains industry accounted for approximately 31 percent of farm cash receipts while the livestock and poultry industry accounted for approximately 42 percent. At the processing level meat and poultry processors contributed about 400 million dollars to Gross Domestic Product while the five grain processing sectors (feed mills, flour mills, breakfast cereal manufacturing, biscuit manufacturing, and bakeries) contributed 473 million dollars to G.D.P. The meat and poultry industry has a high multiplying effect on the rest of the economy. Of the grain sectors only feed mills possesses a higher output multiplier than its major customer, the meat and poultry sector.

The combined use of input-output analysis and national accounting procedures, provides public and private policy makers with a broad base for evaluating the structure and performance of the Canadian economy or any subsystem within it. Input-output analysis provides a method of testing the consistency of sector goals with overall goals for the economy.

Policy Recommendations

In 1964, the Economic Council of Canada proposed five economic and social goals for the Canadian economy [Economic Council of Canada, 1964]. These goals have not been reached. In 1971 the Canadian economy is possibly no closer to attaining these economic and social goals than it was in 1963. Canadian economic policies, both public and private, have failed to steer the economic system and its many subsystems simultaneously towards the achievement of national objectives. The absence of comprehensive, well defined, and well balanced national policies is the factor most limiting balanced progress and economic growth in Canada.

The systems approach provides a means for examining the economic system, with all its ramifications, from a new perspective under changing conditions. Public and private policy makers to date have not only relied upon the conventional concept of the agriculture-agribusiness system but have also relied upon conventional accounting procedures to measure the economic importance of this system. Such an approach to the attainment of national economic and social goals has resulted in stagnant national policies which are not geared towards establishing national priorities for a changing, dynamic Canadian economy.

Future Canadian national policy must strive for an optimum allocation of resources in order to attain all economic and social goals. The interdependence of the many systems within the Canadian economy must be recognized by public and private policy makers in the search for specific policies aimed at fostering a dynamic economy.

To optimize allocation of resources, which in turn must maximize achievement of national economic and social goals, public and private policy makers must:

1) Develop sectoral goals which are consistent with national economic and social goals.

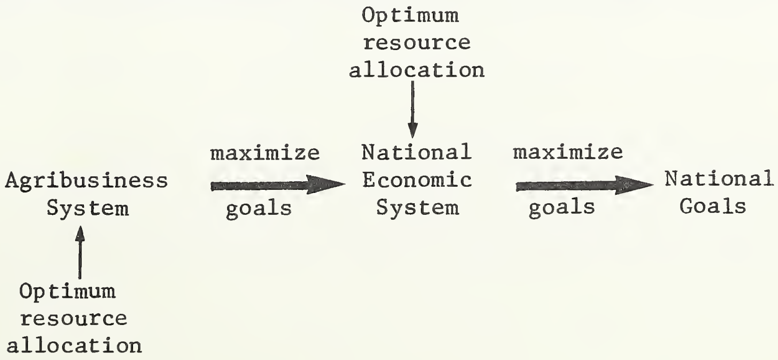
2) Develop an understanding of the internal workings of the Canadian economic system so that realistic priorities may be set up to develop the system to its greatest potential.

To optimize allocation of resources within the agribusiness system, public and private policy makers must:

1) Develop and accept agribusiness goals which are consistent with national economic and social goals.

2) Develop an understanding of how the agribusiness systems work so that realistic priorities may be set up to develop these systems to their greatest potential.

To develop the Canadian agribusiness system to its fullest potential and, in turn, to spur on the national economic system, all private and public policy makers, government agriculture departments, farm leaders, businessmen, university faculties of agriculture, and all individuals interested in the existence of a healthy, dynamic Canadian agribusiness system must acknowledge the need for such a system and then work together to achieve its realization. If these conditions are met, a causal chain of reactions will result:



Research Recommendations

The input-output table developed for 1966 was subject to the limitations of time and finances. The Dominion Bureau of Statistics is presently preparing a very detailed and extensive flow table of Canada to add to their previous tables for 1948 and 1961. Upon release of this work it is recommended that further work be done to define and evaluate the agribusiness system within the Canadian economy.

Dynamic input-output tables, both on a national and on a provincial basis, should be developed to fully document the structure of the Canadian economy. It is imperative that researchers across Canada work together to develop a broad input-output framework which will enable interprovincial comparison of results.

This thesis recommends that Canadian national and provincial accounting methods, including interindustry accounts, place more emphasis on commodity rather than industry classifications. A complete restructuring of present data collecting procedures would be required.

The Dominion Bureau of Statistics should evaluate the need for interindustry studies on both regional and commodity levels. Further development of the intricate procedure used in analyzing regional economies and commodity systems should be undertaken by the input-output section of the Bureau.

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APPENDICES

APPENDIX A

CLASSIFICATION OF INPUT-OUTPUT SECTORS

CLASSIFICATION OF 85 INPUT-OUTPUT SECTORS ACCORDING TO STANDARD INDUSTRIAL CLASSIFICATION

Sector	Standard Industrial Classification										
1. Agriculture	001	003	006	011	013	015	017	019	021		
2. Forestry, hunting and fishing	031	039	041	045	047						
3. Iron, base metal, uranium,	053	054	055	056	059	057	058				
4. Fuel minerals	061	063	065	066	092	094	096	098	099		
5. Non-metal mining	071	073	077	079	083	087					
6. Meat and poultry processors	101	103									
7. Dairy factories	105										
8. Processed cheese	107										
9. Fish products industry	111										
10. Fruit and vegetable canners	112										
11. Feed mills	123										
12. Flour mills	124										
13. Breakfast cereal manufacturing	125										
14. Biscuit manufacturing	128										
15. Bakeries	129										
16. Confectionery	131										
17. Sugar refineries	133										
18. Vegetable oil mills	135										
19. Miscellaneous food manufacturing	139										
20. Soft drink manufacturing	141										
21. Distilleries	143										
22. Breweries and wineries	145										
23. Leaf tobacco processing	147										
24. Tobacco products manufacturing	153										
25. Rubber products	161	163	169								
26. Leather tanneries	172										
27. Shoe and leather manufacturing	174	175	179								
28. Cotton yarn and cloth	183										
29. Wool yarn and cloth	193	197									
30. Synthetic textile mills	201										
31. Other textiles	211	212	213	214	215	216	218	219	221	223	229
32. Other knitting mills	239	231									
33. Clothing industry	242	243	244	245	246	247	248	249			
34. Wood industry	251	252	254	256	258	259					
35. Furniture manufacturing	261	264	266	268							
36. Pulp and paper mills	271										
37. Asphalt roofing	272										
38. Paper containers	273	274									
39. Printing and publishing	286	287	288	289							
40. Iron and steel mills	291										
41. Steel pipe and tube mills	292										
42. Iron founderies	294										
43. Smelting and refining	295										
44. Aluminum processing	296										
45. Copper processing	297										

continued

Appendix A (continued)

Sector	Standard Industrial Classification										
46. Metal processing	298										
47. Boiler and plate metal	301										
48. Fabricated and structural metal	302										
49. Ornamental and architectural metal	303										
50. Metal stamping	304										
51. Wire and wire products	305										
52. Hardware and cutlery	306										
53. Other metal industries	307	308	309								
54. All other machinery and equipment	311	315									
55. Refrigerator and store machinery	318										
56. Aircraft and parts	321										
57. Motor vehicles manufacturing	323	324									
58. Vehicle parts manufacturing	325										
59. Other transportation equipment	326	327	328	324							
60. Manufacturing electrical appliances	331	332									
61. Communications and wire manufacturing	335	338									
62. Electrical industrial equipment	336										
63. Other electrical products manufacturing	334	337	339								
64. Cement and lime	341	343									
65. Concrete and gypsum	345	347	348								
66. Clay and stone	351	352	353								
67. Glass and glass products manufacturing	356										
68. Petroleum products industry	365	369									
69. Chemicals industry	371	373	377								
70. Mixed fertilizer manufacturing	372										
71. Pharmaceuticals	374										
72. Paint and varnish	375										
73. Soaps and cleaners	376										
74. Miscellaneous manufacturing	378	379	381	382	384	385	393	395	397	399	
75. Construction	404	406	409	421							
76. Wholesale and retail trade	602	604	608	611	613	614	615	616	617	618	
	619	621	622	623	624	625	626	627	629	631	642
	647	649	652	654	656	658	663	665	667	669	673
	676	678	681	691	692	693	694	695	696	697	699
77. Transportation and storage	501	502	505	517	519	504	506	507	508	509	512
	515	516	524	527							
78. Communications	543	544	545	548							
79. Utilities	572	574	576	579							
80. Finance	702	704	731	735	737						
81. Health and education	801	803	805	807	809	821	823	825	827		
82. Business services	861	864	866	862							
83. Hotels	875										
84. Restaurants	876										
85. Other services	851	853	854	861	864	866	874	871	872	877	878
	879	893	894	896	897	869	899				

Source: D.B.S., Standard Industrial Classification Manual, Catalogue No. 12-501 and 12-502 (Ottawa: Queen's Printer, 1960).

APPENDIX B

CONCILIATION OF INPUT-OUTPUT ACCOUNTING WITH NATIONAL ACCOUNTS, INCOME AND EXPENDITURE

Table 1

INPUT-OUTPUT FINAL DEMAND[1] OF GOODS AND SERVICES CANADA, 1966 ($ million)

Sector	Final Demand
1. Agriculture	440.8
2. Forestry, hunting and fishing	0.3
3. Iron, base metal, uranium	0.7
4. Fuel minerals	17.5
5. Non-metal mining	0.8
6. Meat and poultry processors	1861.0
7. Dairy factories	881.5
8. Processed cheese	60.9
9. Fish products industry	129.9
10. Fruit and vegetable canners	452.2
11. Feed mills	1.9
12. Flour mills	61.4
13. Breakfast cereal manufacturing	39.2
14. Biscuit manufacturing	86.4
15. Bakeries	677.9
16. Confectionery	336.3
17. Sugar refineries	155.1
18. Vegetable oil mills	13.0
19. Miscellaneous food manufacturing	499.2
20. Soft drink manufacturing	334.3
21. Distilleries	498.9
22. Breweries and wineries	797.3
23. Leaf tobacco processing	23.7
24. Tobacco products manufacturing	836.2
25. Rubber products	242.0
26. Leather tanneries	0.6
27. Shoe and leather manufacturing	298.5
28. Cotton yarn and cloth	5.7
29. Wool yarn and cloth	3.4
30. Synthetic textile mills	53.7
31. Other textiles	114.5
32. Other knitting mills	129.1
33. Clothing industry	2236.0
34. Wood industry	58.0
35. Furniture manufacturing	621.6
36. Pulp and paper mills	136.8
37. Asphalt roofing	7.8
38. Paper containers	2.3
39. Printing and publishing	190.4
40. Iron and steel mills	97.5
41. Steel pipe and tube mills	42.7
42. Iron founderies	33.2
43. Smelting and refining	66.2
44. Aluminum processing	22.9
45. Copper processing	26.8

continued

Table 1 (continued)

Sector	Final Demand
46. Metal processing	52.2
47. Boiler and plate metal	37.0
48. Fabricated and structural metal	102.9
49. Ornamental and architectural metal	103.7
50. Metal stamping	33.8
51. Wire and wire products	7.6
52. Hardware and cutlery	66.2
53. Other metal industries	53.5
54. All other machinery and equipment	1051.8
55. Refrigerator and store machinery	231.9
56. Aircraft and parts	333.0
57. Motor vehicles manufacturing	2219.5
58. Vehicle parts manufacturing	117.7
59. Other transportation equipment	416.2
60. Manufacturing electrical appliances	423.8
61. Communications and wire manufacturing	430.2
62. Electrical industrial equipment	354.9
63. Other electrical products manufacturing	388.5
64. Cement and lime	26.5
65. Concrete and gypsum	65.4
66. Clay and stone	77.0
67. Glass and glass products manufacturing	68.5
68. Petroleum products industry	674.2
69. Chemicals industry	138.6
70. Mixed fertilizer manufacturing	5.3
71. Pharmaceuticals	291.5
72. Paint and varnish	15.4
73. Soaps and cleaners	162.9
74. Miscellaneous manufacturing	562.0
75. Construction	8190.3
76. Wholesale and retail trade	6619.0
77. Transportation and storage	2475.8
78. Communications	685.2
79. Utilities	1029.6
80. Finance	5280.1
81. Health and education	803.0
82. Business services	182.7
83. Hotels	696.2
84. Restaurants	1333.1
85. Other services	1382.3
86. Office supplies	1.9
87. Advertising and travel	1.6
88. Operating supplies	0.7

continued

Table 1 (continued)

Sector	Final Demand
89. Commodity taxes	2473.3
90. Subsidies and government services	153.0
91. Wages and salaries	3479.7
92. Net income, unincorporated	0.0
93. Surplus	783.0
Gross National Expenditure at Market Prices	56677.9

[1] Final Demand by individuals, governments and businesses.

Source: Input-output tables.

Table 2

NATIONAL ACCOUNTS PERSONAL CONSUMER EXPENDITURE[1]
CANADA, 1966 ($ million)

Sector	Value
Food and nonalcoholic beverages	6,374
Alcoholic beverages	1,290
Tobacco products and smokers' accessories	935
Subtotal food and beverages	8,599
Men and boys clothing	790
Womens and childrens clothing	1,493
Footwear	424
Other	230
Subtotal clothing	2,937
Gross rent paid by tenants	1,418
Gross imputed rents	3,390
Other occupancy charges	304
Fuel	468
Electricity	453
Gas	202
Subtotal rent and fuel	6,235
Furniture and household appliances	1,001
Household furnishings	768
Laundry and drycleaning	249
Other	778
Subtotal household supplies	2,796
Services of physicians and related practitioners	842
Hospital care	143
Drugs	437
Other	50
Subtotal medical services and goods	1,472
New and used automobiles	2,095
Other personal transportation equipment	47
Automotive operating expenses	1,395
Purchased transportation	923
Telephone	471
Other communication	66
Subtotal transportation and communication	4,997

continued

Table 2 (continued)

Sector	Value
Recreation equipment and services, entertainment and cultural services	1,284
Books, newspapers and magazines	410
Education	586
Subtotal entertainment	2,280
Personal care and effects	918
Expenditure in restaurants and hotels	1,704
Financial, legal and other services	1,918
Other goods	2,165
Net expenditure abroad	36
Subtotal services	6,741
Grand Total Personal Consumer Expenditure	36,057

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[1] Final Demand by individuals, not businesses or governments.

Source: D.B.S., National Accounts, Income and Expenditure, Catalogue No. 13-201 (Ottawa: Queen's Printer, 1966).

Table 3

GROSS NATIONAL EXPENDITURE AT MARKET PRICES
CANADA, 1966 ($ million)

Expenditure	Value
Personal expenditure on consumer goods and services	34,848
Government expenditure on goods and services	11,286
Current expenditure	8,689
Gross fixed capital formation	2,597
Business gross fixed capital formation	12,493
New residential construction	2,171
New nonresidential construction	4,850
New machinery and equipment	5,472
Value of physical change in inventories	940
Nonfarm business inventories	777
Farm inventories and grain in commercial channels	163
Export of goods and services	13,073
Deduct: Imports of goods and services	-14,280
Residual error of estimate	-240
Gross National Expenditure at Market Prices	58,120

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[1] Total expenditure on goods and services by individuals, governments, and businesses.

Source: D.B.S., National Accounts, Income and Expenditure, Catalogue No. 13-201 (Ottawa: Queen's Printer, 1966).

Table 4

FOREIGN TRADE IN COMMODITIES,
1966, ($ million)

Input-Output		National Accounts	
Imports	9,412	Imports	9,866
Exports	9,983	Exports	10,071
Re-exports	245	Re-exports	255

Sources: D.B.S., Trade of Canada, Catalogue No. 65-201 (Ottawa: Queen's Printer, 1970).

Table 5

SURPLUS AND NET INCOME OF UNINCORPORATED BUSINESS 1966 (million $)

Input-Output		National Accounts	
Net income of unincorporated business		Accrued net income of farms Operators from farm production plus Net income of non-farm unincorporated business	
Total	5,320	Total	5,153
Surplus		Capital consumption allowance and miscellaneous adjustments (unincorporated and corporated businesses)	6,623
		Inventory valuation adjustment (non farm unincorporated and corporate business)	940
		Corporation profits before taxes (before balance of dividends)	5,145
		Interest and other investment income (including interest paid to non residents and after deduction of interest received from non residents)	9,327
Total	15,363	Total Surplus	22,035

Sources: D.B.S., *National Accounts, Income and Expenditure, 1966*, Catalogue No. 13-201 (Ottawa: Queen's Printer, 1967); Input-output tables

Table 6

WAGES AND SALARIES 1966 (million $)

Input-Output		National Accounts	
Aggregated			
Total	28,849	Total	30,282
Disaggregated			
Agriculture	450	Agriculture	228
Forestry, hunting and fishing	537	Forestry	443
Iron, basemetal and uranium	391	Fishing and trapping	37
Coal, petroleum and natural gas	242	Total forestry, fishing and trapping	480
Asbestos and other non-metals	152	Mining, quarrying and oil wells	796
Total Mining	785	Manufacturing	8,516
Manufacturing[1]	13,317	Construction	2,524
Construction	3,009	Transportation	1,863
Transportation and Storage	2,112	Storage	90
Communication	696	Total transportation and storage	1,953
Utilities	429	Communication	701
Wholesale and retail trade	3,947	Electric power, gas and water utilities	512
Finance, insurance and Real estate	1,312	Wholesale trade	1,703
Health and education	129	Retail trade	2,605
Business services	436	Total wholesale and retail trade	4,308
Hotels	484	Finance, insurance and real estate	1,313
Restaurants	521	Public administration and defence[2]	3,523
Other services	685	Services	5,428
Total Services[1]	2,255		

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[1] Wages and salaries paid to services relating to manufacturing are included in manufacturing total.

[2] Wages and salaries paid for public administration and defense included in sector of expenditure in Input-Output accounting.

Source: D.B.S., National Accounts, Income and Expenditure 1966, Catalogue No. 13-201 (Ottawa: Queen's Printer, 1967).

APPENDIX C

MATHEMATICAL MODEL OF INPUT-OUTPUT ANALYSIS

THE MATHEMATICAL MODEL

An input-output model is a set of linear equations describing intersectoral flows of goods and services. Three basic stages of analysis are involved. In stage one, an interindustry flow table is constructed in which the output of each industry of the economy is allocated to every sector that uses this output. For the primary work physical units can be used. For further analysis and aggregation into a workable number of industries, all flows are generally converted to dollar units, usually the value to the producer; resulting in a complete accounting of the flows of all goods and services from one industry to another. When constant input-output ratios hold only for those sectors normally considered as intermediate production activities, and when final demand activities such as households and governments are autonomous, the system is described as "open".

An open system may be described mathematically as follows:

Assume: $i,j = 1,2,3,4 \ldots n$

X_i is the output of sector i

X_{ij} is the output of sector i purchased by sector j

Y_i is the final demand for goods of sector i

An input-output system of equations is as follows:

$$\begin{array}{l} X_1 = X_{11} + X_{12} + X_{13} + X_{1j} + X_{1n} + Y_1 \\ X_2 = X_{21} + X_{22} + X_{23} + X_{2j} + X_{2n} + Y_2 \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_i = X_{i1} + X_{i2} + X_{i3} + X_{ij} + X_{in} + Y_i \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_n = X_{n1} + X_{n2} + X_{n3} + Xnj + X_{nn} + Y_n \end{array} \qquad (1)$$

If the X_{ij} were excluded for $i = j$,[1] the outputs are net quantities. Where X_{ij} for $i = j$ are included the output is gross. If all components of a sector are recognized the sum of the inputs for each industry equals its sum of outputs.[2]

In stage two, a matrix of technical coefficients is developed. Basic assumption number one is involved. Constant returns to scale exists between the purchases of an endogenous sector and the level of output of that sector, as in equation (2),

$$X_{ij} = a_{ij}x_j + c_{ij} \tag{2}$$

in which a_{ij} and c_{ij} are constants, x_{ij} is the amount of output of sector i purchased by sector j, and x_j is the output of sector j. To simplify the empirical work, c_{ij} is assumed to be zero. The technical coefficient a_{ij} is thus derived from a single observation of the ratio $\frac{x_{ij}}{x_j}$, which is the purchase of output of industry i by industry j divided by the gross output of industry j, as in (3):

$$a_{ij} = \frac{x_{ij}}{x_j} .$$

Each sector of the endogenous part of the model is now described in terms of a common unit: dollar inputs per dollar of output. The direct dependence of each sector on any other sector is now quantifiable.

Stage three, the third matrix, summarizes not only the direct dependence, but also the indirect and circular effects of one sector on another. Each interdependence coefficient shows the output required from sector i per dollar of output of sector j delivered to final demand. The

---

[1] This is the set of diagonal elements.

[2] The sums of corresponding columns and rows are equal.

interdependence coefficient shows the output required from sector i per dollar of output of sector j delivered to final demand. The interdependence coefficients are computed directly from the second matrix being the inverse of the difference between an identity matrix and the matrix of technical coefficients following in the mathematical development. Substitute (3) into (1):

$$\begin{array}{l} X_1 - a_{11}x_1 - a_{12}x_2 - \dots - a_{ij}x_j - \dots - a_{1n}x_n = Y_1 \\ X_2 - a_{21}x_1 - a_{22}x_2 - \dots - a_{2j}x_j - \dots - a_{2n}x_n = Y_2 \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_i - a_{i1}x_1 - a_{i2}x_2 - \dots - a_{ij}x_j - \dots - a_{in}x_n = Y_i \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ X_n - a_{n1}x_1 - a_{n2}x_2 - \dots - a_{nj}x_j - \dots - a_{nn}x_n = Y_n \ . \end{array} \tag{4}$$

In matrix notation,

$$X - AX = Y \tag{5}$$

where X is a 1xn column vector of outputs, A is a matrix of technical coefficients of dimension n x n and Y is a 1 x n column vector of final demands.

With specified final demands Y_1, Y_2, Y_i, ... Y_n and constant input-output coefficients, a_{ij}, equations (4) can be solved for the outputs X_1; X_2 ... X_n needed to supply specified deliveries to final demand. This final system of equations is given in (6) where the A_{ij} are resulting interdependence coefficients.

$$\begin{array}{l} X_1 = A_{11}Y_1 + A_{12}Y_2 + \dots A_{1j}Y_j + \dots A_{1n}Y_n \\ X_2 = A_{21}Y_1 + A_{22}Y_2 + \dots A_{2j}Y_j + \dots A_{2n}Y_n \\ \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \end{array} \tag{6}$$

$$\begin{array}{llllll}
\cdot & \cdot & \cdot & \cdot & \cdot \\
X_i = & A_{i1}Y_1 + & A_{i2}Y_2 + \ldots & A_{ij}Y_j + \ldots & A_{in}Y_n \\
\cdot & \cdot & \cdot & \cdot & \cdot \\
X_n = & A_{n1}Y_1 + & A_{n2}Y_2 + \ldots & A_{nj}Y_j + \ldots & A_{nn}Y_n \ .
\end{array}$$

Matrix notation, $X = (I-A)^{-1}$ (7) in which I is an identity matrix of the same dimension as A.

Source: Martin, W.E. and H.O. Carter, A California Interindustry Analysis Emphasizing Agriculture. Giannini Research Foundation Report 250. (Berkeley: University of California, 1962).

APPENDIX D

CONVENTIONAL DEFINITION OF CANADIAN AGRIBUSINESS IN RELATION TO OTHER MAJOR SECTORS OF THE ECONOMY

APPENDIX D

CONVENTIONAL DEFINITIONS OF CANADIAN AGRIBUSINESS IN RELATION TO OTHER MAJOR SECTORS OF THE ECONOMY

Appendix D is presented to further define Canadian agribusiness. Nine aggregated sectors form the theoretical procedure behind formation of the Canadian model. The aggregate sectors are defined by input-output raw subsectors which in turn are defined in Appendix A according to the Standard Industrial Classification Code.

Agribusiness

Input-Output Sector Number	Sector
1	Agriculture
6	Meat and poultry processors
7	Dairy factories
8	Processed cheese
10	Fruit and vegetable canners
11	Feed mills
12	Flour mills
13	Breakfast cereal manufacturing
14	Biscuit manufacturing
15	Bakeries
16	Confectionery
17	Sugar refineries
18	Vegetable oil mills
19	Miscellaneous food mills
20	Soft drink manufacturing
21	Distilleries
22	Brewing and wineries
23	Leaf tobacco processing
24	Tobacco products manufacturing
26	Leather tanneries
27	Shoe factories, glove and luggage manufacturing
28	Cotton yarn and cloth
29	Wool yarn and cloth
33	Clothing industry
70	Mixed fertilizer manufacturing
71	Pharmaceuticals
72	Paint and varnish
84	Restaurants

Renewable Natural Resources

Input-Output Sector Number	Sector
2	Forestry, hunting, and fishing
9	Fish products industry

Non-Renewable Natural Resources

Input-Output Sector Number	Sector
3	Iron, base metal, uranium
4	Fuel minerals
5	Non-metal mining

Personal Items

Input-Output Sector Number	Sector
25	Rubber products
30	Synthetic textile mills
31	Other textiles
32	Other knitting mills
34	Wood industries
35	Furniture manufacturing
57	Motor vehicle manufacturing
60	Manufacturing electrical appliances

Public Items

Input-Output Sector Number	Sector
36	Pulp and paper mills
37	Asphalt roofing
38	Paper containers
39	Printing and publishing
40	Iron and steel mills
41	Steel pipe and tube mills
42	Iron foundries
43	Smelting and refining
44	Aluminum processing
45	Copper processing
46	Metal Processing
47	Boiler and metal plating
48	Fabricated and structural metal
49	Ornament and architectural steel
50	Metal stamping
51	Wire and wire products

Public Items (continued

Input-output Sector Number	Sector
52	Hardware and cutlery
53	Other metal industries
54	All other machinery and equipment
55	Refrigeration and store machinery
56	Aircraft and parts
58	Vehicle parts manufacturing
59	Other transportation equipment
61	Communications wire manufacturing
62	Electrical industrial equipment
63	Other electrical products manufacturing
64	Cement and lime
65	Concrete and gypsum
66	Clay and stone
67	Glass and glass products manufacturing
68	Petroleum products industry
69	Chemicals industry
73	Soaps and cleaners
74	Miscellaneous manufacturing

Services and Trade

Input-Output Sector Number	Sector
75	Construction
76	Wholesale and retail trade
77	Transportation and storage
78	Communications
79	Utilities
80	Finance
81	Health and education
82	Business services
83	Hotels
85	Other services
86	Office supplies
87	Advertising and travel
88	Operating supplies

Government Activity

Input-output Sector Number	Sector
89	Commodity taxes
90	Subsidies and government services

Corporate and Public Earning

Input-Output Sector Number	Sector
91	Wages and salaries
92	Net income, unincorporated
93	Surplus

APPENDIX E

CONCENTRATION OF CANADIAN MANUFACTURING INDUSTRIES, 1964

CONCENTRATION OF CANADIAN MANUFACTURING INDUSTRIES, 1964

	Sector	Total Number of Establishments	Account for 80% of Shipments Number	Percent
1.	Agriculture	-*	-	-
2.	Forestry, hunting, and fishing	-	-	-
3.	Iron, base metal, uranium	-	-	-
4.	Fuel minerals	-	-	-
5.	Nonmetal mining	-	-	-
6.	Meat and poultry processors	541	113.9	21.05
7.	Dairy factories	1535	453.5	29.54
8.	Processed cheese	9	2.5	28.21
9.	Fish products industry	371	90.9	22.60
10.	Fruit and vegetable canners	326	78.2	23.98
11.	Feed mills	890	240.3	27.00
12.	Flour mills	55	16.2	29.46
13.	Breakfast cereal manufacturing	17	3.8	22.15
14.	Biscuit manufacturing	45	13.1	29.16
15.	Bakeries	2548	410.7	16.12
16.	Confectioneries	176	21.5	12.24
17.	Sugar refineries	13	4.4	33.79
18.	Vegetable oil mills	12	3.0	25.17
19.	Miscellaneous food manufacturing	281	60.0	21.36
20.	Soft drink manufacturing	481	157.4	32.72
21.	Distilleries	20	7.1	35.60
22.	Breweries and wineries	68	25.1	36.91
23.	Leaf tobacco processing	18	5.3	29.48
24.	Tobacco products manufacturing	21	6.5	30.95
25.	Rubber products	95	20.5	21.57
26.	Leather tanneries	42	13.0	30.91
27.	Shoe and leather manufacturing	501	158.3	31.60
28.	Cotton yarn and cloth	34	13.4	39.50
29.	Wool yarn and cloth	78	29.5	37.82
30.	Synthetic textile mills	60	18.0	30.07
31.	Other textiles	767	220.6	28.76
32.	Other knitting mills	364	133.9	36.79
33.	Clothing industry	2335	910.8	39.01
34.	Wood industry	4594	729.8	15.89
35.	Furniture manufacturing	2216	401.5	18.12
36.	Pulp and paper mills	131	50.0	38.16
37.	Asphalt roofing	20	7.0	35.21
38.	Paper containers	454	138.7	30.55
39.	Printing and publishing	3439	608.8	17.70
40.	Iron and steel mills	42	9.2	21.96
41.	Steel pipe and tube mills	21	9.0	42.93

continued

Appendix E (continued)

Sector		Total Number of Establishments	Account for 80% of Shipments	
			Number	Percent
42.	Iron founderies	134	28.1	20.96
43.	Smelting and refining	23	9.5	41.30
44.	Aluminum processing	47	5.3	11.37
45.	Copper processing	59	4.4	7.42
46.	Metal processing	72	20.0	27.81
47.	Boiler and plate metal	66	15.6	23.71
48.	Fabricated and structural metal	89	32.4	36.44
49.	Ornamental and architectural metal	641	132.7	20.70
50.	Metal stamping	615	107.6	17.49
51.	Wire and wire products	225	33.8	15.03
52.	Hardware and cutlery	397	87.2	21.97
53.	Other metal industries	1422	424.1	29.82
54.	All other machinery and equipment	590	124.8	21.15
55.	Refrigerator and store machinery	60	17.7	29.50
56.	Aircraft and parts	86	8.7	10.15
57.	Motor vehicles manufacturing	18	4.2	23.06
58.	Vehicle parts manufacturing	302	54.9	18.18
59.	Other transportation equipment	338	84.4	24.97
60.	Manufacturing electrical appliances	120	36.9	30.75
61.	Communications and wire manufacturing	143	22.0	15.40
62.	Electrical industrial equipment	145	35.9	24.76
63.	Other electrical products manufacturing	170	49.7	29.24
64.	Cement and lime	37	18.7	50.54
65.	Concrete and gypsum	822	200.1	24.34
66.	Clay and stone	294	95.6	32.52
67.	Glass and glass products manufacturing	183	35.6	19.45
68.	Petroleum products industry	89	39.5	44.38
69.	Chemicals industry	613	152.6	24.89
70.	Mixed fertilizer manufacturing	61	22.5	36.81
71.	Pharmaceuticals	175	33.1	18.93
72.	Paint and varnish	151	36.0	23.86
73.	Soaps and cleaners	140	8.1	5.79
74.	Miscellaneous manufacturing	2664	152.6	5.73
75.	Construction	-	-	-
76.	Wholesale and retail trade	-	-	-
77.	Transportation and storage	-	-	-
78.	Communications	-	-	-
79.	Utilities	-	-	-
80.	Finance	-	-	-

continued

Appendix E (continued)

Sector	Total Number of Establishments	Account for 80% of Shipments	
		Number	Percent
81. Health and education	-	-	-
82. Business services	-	-	-
83. Hotels	-	-	-
84. Restaurants	-	-	-
85. Other services	-	-	-

*Sectors marked - means data not available.

Source: Stewart, M.D., Concentration in Canadian Manufacturing and Mining Industries. (Ottawa: Economic Council of Canada, 1970).

APPENDIX F

COMPUTATION OF AGRIBUSINESS FLOW CHART FROM INPUT-OUTPUT TABLE

COMPUTATION OF AGRIBUSINESS FLOW CHART
FROM INPUT-OUTPUT TABLE

Agriculture Input Sectors	Input-Output Element	
Construction	Column 1	Row 75
Feed	Column 1	Row 11
Petroleum	Column 1	Row 68
Fertilizer	Column 1	Row 70
Agricultural Chemicals	Column 1	Rows 69, 71
Wholesale and Retail Trade	Column 1	Row 76
Finance, Insurance and Real Estate	Column 1	Row 80
Transportation and Storage	Column 1	Row 77
Utilities	Column 1	Row 79
Total Agricultural Inputs	Column 1	Row 94

Agriculture Output Sectors	Input-Output Element	
Exports	Column 89	Row 1
Wholesale and Retail Trade	Column 76	Row 1
Restaurants	Column 84	Row 1
Consumer Final Demand	Column 93	Row 1
Food Processing	Columns 6-20	Row 1
Alcoholic Beverages	Columns 21,22	Row 1
Tabacco Products	Columns 23,24	Row 1
Textiles	Columns 26-29, and 31-33	Row 1
Leather Products	Column 26	Row 1
Pharmaceuticals and Chemicals	Columns 69,71	Row 1
Paint and Varnish	Column 72	Row 1

Food Processing Outputs	Input-Output Element	
Alcoholic Beverages	Columns 21,22	Rows 6-20
Restaurants	Column 84	Rows 6-20
Wholesale and Retail	Column 76	Rows 6-20
Consumer Final Demand	Column 93	Rows 6-20
Leather Products	Column 26	Rows 6-20
Pharmaceuticals and Chemicals	Columns 69,71	Rows 6-20
Paint and Varnish	Column 72	Rows 6-20
Clothing	Columns 26-29, and 31-33	Rows 6-20
Exports	Column 89	Rows 6-20

Alcoholic Beverages Outputs	Input-Output Element	
Restaurants	Column 84	Rows 21,22
Leather Products	Column 26	Rows 21,22
Pharmaceuticals and Chemicals	Columns 69,71	Rows 21,22
Paint and Varnish	Column 72	Rows 21,22
Exports	Column 89	Rows 21,22
Consumer Final Demand	Column 93	Rows 21,22

Tobacco Products Output	Input-Output Element	
Exports	Column 89	Rows 23,24
Consumer Final Demand	Column 93	Rows 23,24

Textile Products Output	Input-Output Element	
Restaurants	Column 84	Rows 26-29, 31-33
Pharmaceuticals and Chemicals	Columns 69,71	Rows 26-29, 31-33
Paint and Varnish	Column 72	Rows 26-29, 31-33
Wholesale and Retail	Column 76	Rows 26-29, 31-33
Leather Products	Column 26	Rows 26-29, 31-33
Exports	Column 89	Rows 26-29, 31-33
Consumer Final Expenditure	Column 93	Rows 26-29, 31-33

Consumer Final Expenditure	Input-Output Element	
Wholesale and Retail Trade	Column 93	Row 76
Paint and Varnish	Column 93	Row 72
Pharmaceuticals and Chemicals	Column 93	Rows 69,71
Restaurants	Column 93	Row 84
Food	Column 93	Rows 1, 6-20
Alcoholic Beverages	Column 93	Rows 21,22
Tobacco Products	Column 93	Rows 23,24
Clothing and Supplies	Column 93	Rows 26-29, 31-33

*Consumer refers to all individuals, businesses and governments.

APPENDIX G

SALES AND PURCHASES OF SECTORAL AGGREGATES

Table 1

FOOD AND BEVERAGE PROCESSING

AGGREGATE[1] SALES AND PURCHASES 1966 ($ million)

Sector		Sales	Purchases
1.	Agriculture	503.8	3281.1
2.	Forestry, hunting and fishing	9.8	90.0
3.	Iron, base metal, uranium	0.0	0.0
4.	Fuel minerals	0.3	14.1
5.	Non-metal mining	0.0	6.5
6.	Meat and poultry processors	511.5	560.4
7.	Dairy factories	91.0	121.5
8.	Processed cheese	22.7	3.4
9.	Fish products industry	10.9	24.5
10.	Fruit and vegetable canners	78.2	67.4
11.	Feed mills	168.3	42.7
12.	Flour mills	6.7	168.6
13.	Breakfast cereal manufacturing	3.6	0.3
14.	Biscuit manufacturing	28.4	1.0
15.	Bakeries	233.4	0.5
16.	Confectionery	76.1	43.7
17.	Sugar refineries	0.2	129.3
18.	Vegetable oil mills	0.7	97.5
19.	Miscellaneous food manufacturing	126.9	239.4
20.	Soft drink manufacturing	84.4	46.8
21.	Distilleries	83.4	71.8
22.	Breweries and wineries	91.9	6.5
23.	Leaf tobacco processing	3.1	269.4
24.	Tobacco products manufacturing	275.0	1.3
25.	Rubber products	0.6	0.0
26.	Leather tanneries	24.4	0.0
27.	Shoe and leather manufacturing	0.0	0.0
28.	Cotton yarn and cloth	2.4	1.0
29.	Wool yarn and cloth	0.0	0.0
30.	Synthetic textile mills	5.7	0.3
31.	Other textiles	5.7	23.2
32.	Other knitting mills	0.0	0.3
33.	Clothing industry	2.6	0.0
34.	Wood industry	1.2	20.8
35.	Furniture manufacturing	0.4	0.0
36.	Pulp and paper mills	7.1	31.5
37.	Asphalt roofing	0.0	0.0
38.	Paper containers	0.4	389.1
39.	Printing and publishing	0.0	24.5
40.	Iron and steel mills	1.1	2.4
41.	Steel pipe and tube mills	0.0	0.0
42.	Iron founderies	0.0	0.0
43.	Smelting and refining	0.0	0.0
44.	Aluminum processing	0.2	0.1
45.	Copper processing	0.1	0.0

continued

Table 1 (continued)

Sector	Sales	Purchases
46. Metal processing	0.2	0.0
47. Boiler and plate metal	0.0	0.0
48. Fabricated and structural metal	0.1	185.6
49. Ornamental and architectural metal	0.0	0.0
50. Metal stamping	0.1	0.0
51. Wire and wire products	0.1	0.1
52. Hardware and cutlery	0.0	0.0
53. Other metal industries	0.1	0.0
54. All other machinery and equipment	0.5	0.0
55. Refrigerator and store machinery	0.0	4.1
56. Aircraft and parts	0.0	0.0
57. Motor vehicles manufacturing	0.0	0.0
58. Vehicle parts manufacturing	0.0	0.0
59. Other transportation equipment	0.0	0.0
60. Manufacturing electrical appliances	0.0	0.0
61. Communications and wire manufacturing	0.0	0.0
62. Electrical industrial equipment	0.0	0.0
63. Other electrical products manufacturing	0.0	0.0
64. Cement and lime	0.0	0.0
65. Concrete and gypsum	0.6	0.0
66. Clay and stone	0.1	0.0
67. Glass and glass products manufacturing	0.0	91.2
68. Petroleum products industry	0.7	48.6
69. Chemicals industry	13.0	67.1
70. Mixed fertilizer manufacturing	0.5	0.0
71. Pharmaceuticals	6.9	12.1
72. Paint and varnish	7.9	0.1
73. Soaps and cleaners	29.3	0.4
74. Miscellaneous manufacturing	1.1	45.9
75. Construction	0.4	32.0
76. Wholesale and retail trade	20.3	209.8
77. Transportation and storage	1.1	327.4
78. Communications	0.0	31.8
79. Utilities	0.0	67.6
80. Finance	0.0	95.1
81. Health and education	0.0	0.0
82. Business services	0.0	77.0
83. Hotels	91.9	18.3
84. Restaurants	578.0	0.0
85. Other services	2.4	30.1

continued

Table 1 (continued)

Sector	Sales	Purchases
86. Office supplies	0.0	19.6
87. Advertising and travel	61.7	468.8
88. Operating supplies	93.1	247.5
89. Net exports (commodity taxes)*	777.6	204.0
90. Re-exports (subsidies and government services)	9.7	65.4
91. Imports (wages and salaries)	912.9	1782.7
92. Inventory (net income, unincorporated)	9.2	554.2
93. Final demand (surplus)	7746.2	1037.2
Total	11005.6	11005.6

[1] Sectors 6 to 24 inclusive.

* Titles in parentheses refer only to purchases for respective rows.

Source: Derived from input-output tables.

Table 2

FIBER INDUSTRY AGGREGATE[1] SALES AND PURCHASES

1966 ($ million)

	Sector	Sales	Purchases
1.	Agriculture	27.3	30.1
2.	Forestry, hunting and fishing	9.9	37.8
3.	Iron, base metal, uranium	0.5	0.0
4.	Fuel minerals	0.0	4.7
5.	Non-metal mining	3.3	1.6
6.	Meat and poultry processors	2.5	24.0
7.	Dairy factories	0.2	0.0
8.	Processed cheese	0.1	0.0
9.	Fish products industry	0.1	0.2
10.	Fruit and vegetable canners	0.0	0.0
11.	Feed mills	7.1	0.0
12.	Flour mills	10.5	0.6
13.	Breakfast cereal manufacturing	0.1	0.0
14.	Biscuit manufacturing	0.0	0.0
15.	Bakeries	0.1	0.0
16.	Confectionery	0.1	0.0
17.	Sugar refineries	1.3	0.0
18.	Vegetable oil mills	1.4	8.6
19.	Miscellaneous food manufacturing	1.0	1.9
20.	Soft drink manufacturing	0.0	0.0
21.	Distilleries	0.0	0.0
22.	Breweries and wineries	0.0	0.0
23.	Leaf tobacco processing	0.0	0.0
24.	Tobacco products manufacturing	0.0	0.0
25.	Rubber products	65.8	17.9
26.	Leather tanneries	0.0	67.2
27.	Shoe and leather manufacturing	93.3	13.7
28.	Cotton yarn and cloth	105.3	509.8
29.	Wool yarn and cloth	11.5	177.3
30.	Synthetic textile mills	21.3	270.0
31.	Other textiles	185.8	222.6
32.	Other knitting mills	7.0	110.6
33.	Clothing industry	804.9	106.7
34.	Wood industry	0.6	3.7
35.	Furniture manufacturing	37.0	0.0
36.	Pulp and paper mills	19.3	8.4
37.	Asphalt roofing	0.2	0.0
38.	Paper containers	4.8	30.7
39.	Printing and publishing	2.4	0.1
40.	Iron and steel mills	0.0	0.3
41.	Steel pipe and tube mills	0.0	0.2
42.	Iron founderies	0.0	0.0
43.	Smelting and refining	0.1	0.6
44.	Aluminum processing	0.0	0.0
45.	Copper processing	0.0	0.0

continued

Table 2 (continued)

Sector	Sales	Purchases
46. Metal processing	0.0	0.0
47. Boiler and plate metal	0.0	0.0
48. Fabricated and structural metal	0.0	0.4
49. Ornamental and architectural metal	0.1	0.7
50. Metal stamping	0.1	0.3
51. Wire and wire products	0.5	1.7
52. Hardware and cutlery	0.0	2.3
53. Other metal industries	0.1	0.0
54. All other machinery and equipment	0.5	0.4
55. Refrigerator and store machinery	0.1	1.4
56. Aircraft and parts	0.7	0.0
57. Motor vehicles manufacturing	43.8	0.0
58. Vehicle parts manufacturing	0.8	0.0
59. Other transportation equipment	2.4	0.0
60. Manufacturing electrical appliances	0.4	0.7
61. Communications and wire manufacturing	3.2	0.0
62. Electrical industrial equipment	1.1	0.0
63. Other electrical products manufacturing	0.2	0.0
64. Cement and lime	0.2	0.1
65. Concrete and gypsum	0.3	0.0
66. Clay and stone	3.2	0.1
67. Glass and glass products manufacturing	0.0	0.2
68. Petroleum products industry	0.0	5.7
69. Chemicals industry	1.3	42.0
70. Mixed fertilizer manufacturing	0.1	0.0
71. Pharmaceuticals	0.6	0.0
72. Paint and varnish	0.1	1.0
73. Soaps and cleaners	2.6	0.2
74. Miscellaneous manufacturing	18.0	113.3
75. Construction	60.8	6.9
76. Wholesale and retail trade	59.1	149.5
77. Transportation and storage	8.6	46.8
78. Communications	1.9	15.4
79. Utilities	0.0	17.9
80. Finance	0.0	64.9
81. Health and education	7.0	0.0
82. Business services	0.1	11.8
83. Hotels	30.9	8.6
84. Restaurants	9.3	0.0
85. Other services	18.8	6.1

continued

Table 2 (continued)

Sector	Sales	Purchases
86. Office supplies	1.3	10.2
87. Advertising and travel	4.4	87.3
88. Operating supplies	26.1	70.3
89. Net exports (commodity taxes)*	174.1	96.0
90. Re-exports (subsidies and government services)	6.6	18.6
91. Imports (wages and salaries)	837.9	1149.7
92. Inventory (net income, unincorporated)	-92.5	27.6
93. Final demand (surplus)	2787.9	164.3
Total	5814.9	5814.9

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[1] Sectors 26 to 29 and 31 to 33 inclusive.

* Titles in parenthesis refer only to purchases for respective rows.

Source: Derived from input-output tables.

Table 3

CHEMICAL INDUSTRY AGGREGATE[1] SALES AND PURCHASES
CANADA 1966 ($ million)

	Sector	Sales	Purchases
1.	Agriculture	164.4	1.1
2.	Forestry, hunting and fishing	1.6	0.1
3.	Iron, base metal, uranium	37.4	5.7
4.	Fuel minerals	7.0	13.4
5.	Non-metal mining	12.0	28.0
6.	Meat and poultry processors	9.0	6.8
7.	Dairy factories	1.2	0.9
8.	Processed cheese	1.6	0.0
9.	Fish products industry	0.5	4.1
10.	Fruit and vegetable canners	4.1	0.0
11.	Feed mills	10.9	0.1
12.	Flour mills	1.4	0.5
13.	Breakfast cereal manufacturing	0.1	0.0
14.	Biscuit manufacturing	2.5	0.0
15.	Bakeries	17.1	0.0
16.	Confectionery	5.9	0.1
17.	Sugar refineries	0.7	0.8
18.	Vegetable oil mills	0.5	38.8
19.	Miscellaneous food manufacturing	7.9	2.3
20.	Soft drink manufacturing	8.1	0.0
21.	Distilleries	3.1	3.2
22.	Breweries and wineries	5.4	0.0
23.	Leaf tobacco processing	0.0	0.0
24.	Tobacco products manufacturing	0.0	0.0
25.	Rubber products	85.5	3.1
26.	Leather tanneries	3.2	0.0
27.	Shoe and leather manufacturing	2.7	0.0
28.	Cotton yarn and cloth	5.1	3.5
29.	Wool yarn and cloth	0.3	0.0
30.	Synthetic textile mills	48.7	2.5
31.	Other textiles	30.1	1.1
32.	Other knitting mills	0.1	0.0
33.	Clothing industry	1.7	0.0
34.	Wood industry	22.0	1.7
35.	Furniture manufacturing	10.5	0.0
36.	Pulp and paper mills	67.8	10.0
37.	Asphalt roofing	3.1	0.0
38.	Paper containers	23.5	52.0
39.	Printing and publishing	2.1	0.3
40.	Iron and steel mills	4.8	6.3
41.	Steel pipe and tube mills	0.3	0.0
42.	Iron founderies	1.6	0.0
43.	Smelting and refining	4.7	9.5
44.	Aluminum processing	1.5	0.0
45.	Copper processing	0.5	1.0

continued

Table 3 (continued)

Sector	Sales	Purchases
46. Metal processing	0.8	0.3
47. Boiler and plate metal	0.3	0.0
48. Fabricated and structural metal	0.6	28.9
49. Ornamental and architectural metal	1.8	0.0
50. Metal stamping	6.0	0.6
51. Wire and wire products	3.5	0.2
52. Hardware and cutlery	0.6	0.0
53. Other metal industries	0.9	0.0
54. All other machinery and equipment	7.2	5.7
55. Refrigerator and store machinery	1.9	3.9
56. Aircraft and parts	1.8	0.0
57. Motor vehicles manufacturing	31.2	0.0
58. Vehicle parts manufacturing	4.6	0.0
59. Other transportation equipment	3.2	0.0
60. Manufacturing electrical appliances	6.8	0.1
61. Communications and wire manufacturing	24.5	0.0
62. Electrical industrial equipment	3.1	0.0
63. Other electrical products manufacturing	16.7	0.0
64. Cement and lime	0.1	1.9
65. Concrete and gypsum	4.6	0.0
66. Clay and stone	7.4	2.4
67. Glass and glass products manufacturing	13.0	20.0
68. Petroleum products industry	60.7	61.8
69. Chemicals industry	192.8	287.8
70. Mixed fertilizer manufacturing	57.1	37.4
71. Pharmaceuticals	30.2	19.5
72. Paint and varnish	39.0	4.6
73. Soaps and cleaners	32.0	1.8
74. Miscellaneous manufacturing	110.8	65.5
75. Construction	95.7	14.1
76. Wholesale and retail trade	7.0	42.7
77. Transportation and storage	5.7	63.0
78. Communications	0.2	13.1
79. Utilities	0.7	46.4
80. Finance	15.7	30.6
81. Health and education	28.0	0.0
82. Business services	0.2	14.9
83. Hotels	0.2	7.8
84. Restaurants	0.2	0.0
85. Other services	49.0	16.6

continued

Table 3 (continued)

Sector	Sales	Purchases
86. Office supplies	4.3	6.9
87. Advertising and travel	1.2	155.3
88. Operating supplies	221.8	56.2
89. Net exports (commodity taxes)*	401.7	2.5
90. Re-exports (subsidies and government services)	7.1	20.7
91. Imports (wages and salaries)	606.9	453.2
92. Inventory (net income, unincorporated)	-87.2	1.2
93. Final demand (surplus)	613.6	359.0
Total	2043.5	2043.5

[1] Sectors 69 to 73 inclusive.

* Titles in parenthesis refer only to purchases for respective rows.

Source: Derived from input-output tables.

APPENDIX H

GOODS AND SERVICES OUTPUT MULTIPLIERS, 1966

GOODS AND SERVICES OUTPUT MULTIPLIERS, 1966

Sector No.	Title	Output Multiplier[1]	Rank #1[2]	Weighted[3] Output Multipliers ($ Million)	Rank #2[4]	1966 Final[5] Demand ($ Million)
17	Sugar refineries	6.160569	1	95.6	38	155.1
68	Petroleum products industry	5.982771	2	403.4	15	674.2
45	Copper processing	5.979566	3	16.0	67	26.8
18	Vegetable oil mills	5.867021	4	7.6	74	13.0
43	Smelting and refining	5.797845	5	38.4	52	66.2
23	Leaf tobacco processing	5.796937	6	13.7	70	23.7
19	Miscellaneous food mfg.	5.749972	7	287.0	19	499.2
11	Feed mills	5.691627	8	1.1	80	1.9
70	Mixed fertilizer mfg.	5.688644	9	3.0	79	5.3
6	Meat and poultry processing	5.661729	10	1053.6	6	1861.0
24	Tobacco products mfg.	5.657228	11	473.0	13	836.2
41	Steel pipe and tube mills	5.640128	12	24.1	63	42.7
79	Utilities	5.633550	13	580.0	9	1029.6
12	Flour mills	5.618834	14	34.5	54	61.4
21	Distilleries	5.608187	15	279.8	21	498.9
46	Metal processing	5.576882	16	29.1	59	52.2
44	Aluminium processing	5.527551	17	12.6	71	22.9
8	Processed cheese	5.501540	18	33.5	55	60.9
7	Dairy factories	5.489161	19	483.9	11	881.5
64	Cement and lime	5.470500	20	14.5	69	26.5
73	Soaps and cleaners	5.453385	21	88.8	39	162.9
13	Breakfast cereal mfg.	5.378806	22	21.1	64	39.2
10	Fruit and vegetable canners	5.374948	23	243.0	24	452.2
69	Chemical industry	5.371724	24	74.4	41	138.6
4	Fuel minerals	5.370080	25	9.4	72	17.5
37	Asphalt roofing	5.361984	26	4.2	75	7.8
28	Cotton yarn and cloth	5.354135	27	3.0	78	5.7
57	Motor vehicles mfg.	5.272653	28	117.0	4	2219.5
22	Breweries and wineries	5.265113	29	419.8	14	797.3
26	Leather tanneries	5.183086	30	.3	84	.6
40	Iron and steel mills	5.164377	31	50.4	48	97.5
30	Synthetic textile mills	5.154487	32	27.7	60	53.7
3	Iron, base metal, uranium	5.144717	33	.4	77	.7
14	Biscuit manufacturing	5.134045	34	44.4	51	86.4
80	Finance	5.130568	35	2709.0	3	5280.1
38	Paper containers	5.126855	36	1.2	82	2.3
31	Other textiles	5.121472	37	58.6	45	114.5
16	Confectioneries	5.110996	38	171.9	30	336.3
72	Paint and varnish	5.101444	39	7.8	73	15.4
65	Concrete and gypsum	5.097577	40	33.3	56	65.4
36	Pulp and paper mills	5.093741	41	69.7	42	136.8
25	Rubber products	5.079811	42	122.9	36	242.0
50	Metal stamping	5.038084	43	17.0	66	33.8
20	Soft drink manufacturing	5.028381	44	168.1	31	334.3

continued

Appendix H (continued)

Sector No.	Title	Output Multiplier[1]	Rank #1[2]	Weighted[3] Output Multipliers ($ Million)	Rank #2[4]	1966 Final[5] Demand ($ Million)
1	Agriculture	5.027804	45	226.6	25	440.8
5	Nonmetal mining	5.026259	46	.4	83	.8
51	Wire and wire products	5.005071	47	3.8	76	7.6
71	Pharmaceuticals	4.954075	48	144.4	33	291.5
15	Bakeries	4.903533	49	332.4	16	677.9
63	Other electrical products mfg.	4.901125	50	190.4	28	388.5
55	Refrigerator and store machinery	4.882100	51	113.2	37	231.9
29	Wool yarn and cloth	4.879179	52	1.6	81	3.4
9	Fish products industry	4.872363	53	63.3	43	130.0
60	Mfg. electrical appliances	4.871749	54	206.5	26	423.8
32	Other knitting mills	4.854905	55	62.7	44	129.1
58	Vehicle parts mfg.	4.785484	56	56.3	46	117.7
74	Miscellaneous mfg.	4.776839	57	268.4	22	562.0
66	Clay and stone	4.729177	58	36.4	53	77.0
49	Ornamental & architectural metal	4.728820	59	49.0	49	103.7
48	Fabricated & structural metal	4.725642	60	48.6	50	102.9
47	Boiler and plate metal	4.689017	61	17.3	65	37.0
33	Clothing industry	4.673418	62	1045.0	7	2236.0
53	Other metal industries	4.688059	63	25.1	62	53.5
61	Communications and wire mfg.	4.634070	64	199.3	27	430.2
42	Iron founderies	4.601368	65	15.3	68	33.2
67	Glass and glass products	4.597476	66	31.5	57	68.5
35	Furniture manufacturing	4.575788	67	284.4	20	621.6
54	All other machinery & equipment	4.568795	68	480.5	12	1051.8
34	Wood industry	4.560596	69	26.4	61	58.0
84	Restaurants	4.555537	70	607.3	8	1833.1
27	Shoe and leather mfg.	4.537840	71	135.4	35	298.5
52	Hardware and cutlery	4.529601	72	30.0	58	66.2
75	Construction	4.513923	73	3697.0	1	8190.3
77	Transportation and storage	4.378057	74	1083.9	5	2475.8
62	Electrical industrial equipment	4.363418	75	154.8	32	354.9
39	Printing and publishing	4.323699	76	82.3	40	190.4
78	Communications	4.293468	77	294.2	17	685.2
2	Forestry, hunting and fishing	4.282735	78	.1	85	.3
59	Other transportation equipment	4.224534	79	175.8	29	416.2
56	Aircraft and parts	4.174815	80	139.0	34	333.0
83	Hotels	4.171782	81	290.4	18	696.2
76	Wholesale and retail trade	4.133029	82	2735.0	2	6619.0
85	Other services	4.053819	83	560.4	10	1382.3
81	Health and education	3.241175	84	260.3	23	803.0
82	Business services	3.006263	85	54.9	47	182.7

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[1] Output multipliers derived from Appendix K.

[2] Ranking of output multipliers.

[3] Output multipliers (column #1) for each sector are multiplied by an amount equal to 10 percent of the 1966 final demand of column #5.

[4] Ranking of weighted output multipliers.

APPENDIX I

GROSS DOMESTIC PRODUCT BY INDUSTRIAL SECTOR, CANADA, 1966

INPUT-OUTPUT GROSS DOMESTIC PRODUCT BY INDUSTRIAL SECTOR CANADA 1966 ($ million)

	Sector	Gross Domestic Product 1966
1.	Agriculture	2705.8
2.	Forestry, hunting and fishing	838.2
3.	Iron, base metal, uranium	1093.2
4.	Fuel minerals	732.8
5.	Non-metal mining	336.5
6.	Meat and poultry processors	399.8
7.	Dairy factories	239.9
8.	Processed cheese	23.3
9.	Fish products industry	38.0
10.	Fruit and vegetable canners	136.9
11.	Feed mills	75.7
12.	Flour mills	32.9
13.	Breakfast cereal manufacturing	16.9
14.	Biscuit manufacturing	41.8
15.	Bakeries	305.5
16.	Confectionery	113.3
17.	Sugar refineries	49.8
18.	Vegetable oil mills	11.2
19.	Miscellaneous food manufacturing	159.6
20.	Soft drink manufacturing	219.2
21.	Distilleries	374.7
22.	Breweries and wineries	367.0
23.	Leaf tobacco processing	29.2
24.	Tobacco products manufacturing	240.3
25.	Rubber products	261.5
26.	Leather tanneries	14.3
27.	Shoe and leather manufacturing	119.5
28.	Cotton yarn and cloth	163.0
29.	Wool yarn and cloth	13.3
30.	Synthetic textile mills	204.4
31.	Other textiles	167.2
32.	Other knitting mills	9.5
33.	Clothing industry	854.7
34.	Wood industry	602.8
35.	Furniture manufacturing	262.3
36.	Pulp and paper mills	1130.7
37.	Asphalt roofing	23.5
38.	Paper containers	250.0
39.	Printing and publishing	539.7
40.	Iron and steel mills	439.8
41.	Steel pipe and tube mills	54.7
42.	Iron founderies	76.6
43.	Smelting and refining	133.2
44.	Aluminum processing	41.4
45.	Copper processing	49.5

continued

Appendix I (continued)

Sector	Gross Domestic Product 1966
46. Metal processing	24.8
47. Boiler and plate metal	31.4
48. Fabricated and structural metal	65.5
49. Ornamental and architectural metal	106.9
50. Metal stamping	111.1
51. Wire and wire products	158.1
52. Hardware and cutlery	61.1
53. Other metal industries	60.7
54. All other machinery and equipment	526.5
55. Refrigerator and store machinery	207.5
56. Aircraft and parts	318.9
57. Motor vehicles manufacturing	647.5
58. Vehicle parts manufacturing	295.1
59. Other transportation equipment	237.2
60. Manufacturing electrical appliances	163.9
61. Communications and wire manufacturing	394.1
62. Electrical industrial equipment	233.5
63. Other electrical products manufacturing	233.6
64. Cement and lime	101.7
65. Concrete and gypsum	142.1
66. Clay and stone	158.3
67. Glass and glass products manufacturing	147.7
68. Petroleum products industry	351.1
69. Chemicals industry	509.1
70. Mixed fertilizer manufacturing	24.0
71. Pharmaceuticals	132.2
72. Paint and varnish	78.1
73. Soaps and cleaners	69.9
74. Miscellaneous manufacturing	521.6
75. Construction	3715.0
76. Wholesale and retail trade	6308.5
77. Transportation and storage	3404.7
78. Communications	1295.8
79. Utilities	1590.5
80. Finance	4611.3
81. Health and education	580.0
82. Business services	836.8
83. Hotels	776.0
84. Restaurants	835.9
85. Other services	1208.4
86. Office supplies	0.0
87. Advertising and travel	0.0
88. Operating supplies	0.0
89. Commodity taxes	0.0
90. Subsidies and government services	0.0
91. Wages and salaries	0.0

continued

Appendix I (continued)

Sector	Gross Domestic Product 1966
92. Net income, unincorporated	0.0
93. Surplus	4262.7
Total	49432.2

Source: Input-output tables

APPENDIX J

WAGES AND SALARIES GENERATED BY REQUIREMENTS FOR PRODUCTS OF CANADIAN GOODS AND SERVICES PRODUCING SECTORS, 1966

WAGES AND SALARIES GENERATED BY REQUIREMENTS FOR PRODUCTS OF
CANADIAN GOODS AND SERVICES PRODUCING SECTORS, 1966

Sector No.	Title	Direct Wages and Salaries per Dollar Output, 1966[1]	Rank[2]	Direct plus Indirect Wages and Salaries per Dollar Output, 1966[3]	Rank[4]	Total 1966 Wages and Salaries ($ Million)[5]	Rank[6]	Wage and Salary Effects of a 10% Change in Final Demand 1966[7]	Rank[8]	Percent Change in Total Wage and Salaries Resulting From a 10% Change in Final Demand, 1966[9]	Rank[10]
17	Sugar refineries	.1100	79	.8626	64	19.2	75	13.4	40	69.8	2
68	Petroleum products industry	.0644	83	.8840	57	113.2	46	59.6	16	52.7	4
45	Copper processing	.1434	74	.9163	30	36.1	69	2.4	68	6.8	54
18	Vegetable oil mills	.0441	85	.7228	81	5.5	85	.2	80	2.9	71
43	Smelting and refining	.1208	77	.9128	36	89.2	56	6.0	55	6.8	53
23	Leaf tobacco processing	.0540	84	.7181	82	18.0	77	1.7	71	9.5	50
19	Miscellaneous food manufacturing	.1412	75	.8616	65	92.3	54	43.0	22	46.6	6
11	Feed mills	.1063	80	.7918	74	55.7	63	.2	81	.3	77
70	Mixed fertilizer manufacturing	.1479	71	.7649	78	18.0	76	.4	77	2.2	74
6	Meat and poultry processing	.1174	78	.7606	80	320.8	21	141.5	7	44.1	8
24	Tobacco products manufacturing	.1727	66	.8281	71	142.6	38	69.2	13	48.6	5
41	Steel pipe and tube mills	.1291	76	.9148	34	25.6	74	3.9	63	15.2	39
79	Utilities	.1783	64	.8950	51	429.2	16	92.1	11	21.5	32
12	Flour mills	.0881	81	.7610	79	31.9	70	4.7	62	14.6	40
21	Distilleries	.1445	72	.8751	61	106.3	52	43.6	21	41.1	10
46	Metal processing	.1846	62	.9118	37	17.0	78	4.8	61	28.1	21
44	Aluminum processing	.2227	55	.9234	17	39.1	67	2.1	70	5.4	62
8	Processed cheese	.1532	70	.8579	66	11.4	81	5.2	57	45.6	7
7	Dairy factories	.1444	73	.7678	77	179.6	34	67.7	14	37.7	11
64	Cement and lime	.2034	57	.8990	48	36.8	68	2.4	69	6.5	56
73	Soaps and cleaners	.1820	63	.8804	58	43.2	66	14.3	39	33.2	16
13	Breakfast cereal manufacturing	.2024	58	.8692	62	9.3	83	3.4	65	36.6	13
10	Fruit and vegetable canners	.1770	65	.8646	63	91.1	55	39.1	26	42.9	9
63	Chemical industry	.2170	56	.9056	43	247.6	25	12.6	41	5.1	64
4	Fuel minerals	.2019	59	.8758	60	242.3	26	1.5	72	.1	80
37	Asphalt roofing	.1997	60	.9080	40	11.8	80	.7	74	6.0	57
28	Cotton yarn and cloth	.2508	48	.9161	32	119.6	44	.5	76	0.0	84
57	Motor vehicles manufacturing	.1639	68	.9237	16	388.2	19	205.0	6	52.8	3
22	Breweries and wineries	.2238	54	.8883	56	190.4	33	70.8	12	37.2	12
26	Leather tanneries	.2560	47	.8571	67	14.9	79	.1	84	.3	78
40	Iron and steel mills	.2598	45	.9165	29	259.1	24	8.9	50	3.4	69
30	Synthetic textile mills	.2579	46	.9195	21	126.6	43	4.9	60	3.9	68
3	Iron, base metal, uranium	.2762	40	.9044	44	391.3	18	.1	83	0.0	85
14	Biscuit manufacturing	.2771	39	.8928	52	29.9	71	7.7	51	25.8	25
80	Finance	.1657	67	.7950	73	1312.0	4	419.8	3	32.0	18
38	Paper containers	.2353	52	.9144	35	192.6	32	.2	79	.1	79
31	Other textiles	.2445	51	.9162	31	133.6	39	10.5	47	7.9	52
16	Confectioneries	.2737	41	.8888	55	88.2	57	29.9	33	33.9	15
72	Paint and varnish	.2488	49	.9080	41	57.4	62	1.4	73	2.4	73
65	Concrete and gypsum	.2479	50	.9078	42	102.8	53	5.9	56	5.8	60
36	Pulp and paper mills	.2253	53	.8979	50	554.9	8	12.3	42	2.2	75
25	Rubber products	.2839	36	.9178	26	174.0	35	22.2	36	12.8	43

continued

Appendix J (continued)

Sector No.	Title	Direct Wages and Salaries per Dollar Output, 1966[1]	Rank[2]	Direct plus Indirect Wages and Salaries per Dollar Output, 1966[3]	Rank[4]	Total 1966 Wages and Salaries ($ Million)[5]	Rank[6]	Wage and Salary Effects of a 10% Change in Final Demand 1966[7]	Rank[8]	Percent Change in Total Wage and Salaries Resulting From a 10% Change in Final Demand, 1966[9]	Rank[10]
50	Metal stamping	.2592	44	.9232	18	74.2	60	3.1	66	4.2	66
20	Soft drink manufacturing	.2914	33	.8997	47	126.6	42	30.1	31	23.7	69
1	Agriculture	.0766	82	.6790	83	450.4	13	29.9	32	6.6	55
5	Nonmetal mining	.2903	34	.8985	49	152.1	37	.1	82	.1	82
51	Wire and wire products	.2805	37	.9297	12	112.9	48	.7	75	.1	81
71	Pharmaceuticals	.2782	38	.9000	46	86.9	59	26.2	35	30.2	19
15	Bakeries	.2989	29	.8546	68	229.0	28	57.9	17	25.3	26
63	Other electrical products mfg.	.2648	43	.9263	13	167.3	36	36.0	27	21.5	31
55	Refrigerator and stove machinery	.2951	31	.9176	27	112.8	49	21.3	37	18.9	34
29	Wool yarn and cloth	.2943	32	.9172	28	10.4	82	.3	78	3.0	70
9	Fish products industry	.1929	61	.8790	59	34.7	72	11.4	44	32.9	17
60	Mfg. electrical appliances	.2664	42	.9288	10	133.5	40	39.4	24	29.5	20
32	Other knitting mills	.2997	28	.9262	14	8.0	84	12.0	43	148.9	1
58	Vehicle parts manufacturing	.3059	27	.9353	6	236.1	27	11.0	46	4.7	65
74	Miscellaneous manufacturing	.3252	24	.9117	38	373.8	20	51.2	20	13.7	40
66	Clay and stone	.3423	17	.9190	23	117.6	45	7.1	52	6.0	58
49	Ornamental and architectural metal	.3289	23	.9183	25	84.8	59	9.5	49	11.2	46
48	Fabricated and structural metal	.3404	19	.9365	4	55.2	64	9.6	48	17.5	36
47	Boiler and plate metal	.3303	22	.9319	8	27.0	73	3.4	64	12.7	44
33	Clothing industry	.3235	25	.9186	24	751.6	5	205.4	5	27.3	23
53	Other metal industries	.3398	20	.9245	15	48.2	65	4.9	59	10.3	49
61	Communications and wire mfg.	.3745	10	.9357	5	304.9	22	40.2	23	13.2	42
42	Iron founderies	.3811	9	.9282	11	59.8	61	3.1	67	5.2	63
67	Glass and glass products	.3612	13	.9295	9	108.8	51	6.4	53	5.9	59
35	Furniture manufacturing	.3306	21	.9100	39	202.8	30	56.6	18	27.9	22
54	All other machinery and equipment	.3408	18	.9349	7	432.3	15	98.3	10	22.7	30
34	Wood industry	.2851	35	.8910	54	475.2	12	5.2	58	1.1	76
84	Restaurants	.2960	30	.7839	75	521.3	10	104.5	9	20.0	33
27	Shoe and leather manufacturing	.3661	12	.9158	33	111.6	50	27.3	34	24.4	27
52	Hardware and cutlery	.3680	11	.9230	19	112.8	47	6.1	54	5.4	61
75	Construction	.3103	26	.8914	53	3008.7	2	721.2	1	24.0	28
77	Transportation and storage	.3997	7	.9012	45	2112.2	3	223.1	4	10.6	48
62	Electrical industrial equipment	.4050	5	.9405	3	198.6	31	33.4	29	16.8	37
39	Printing and publishing	.4094	4	.9191	22	412.2	17	17.5	38	4.2	67
78	Communications	.4369	1	.9214	20	696.0	6	63.1	15	9.0	51
2	Forestry, hunting, and fishing	.3512	15	.8398	69	536.8	9	0.0	85	0.0	83
59	Other transportation equipment	.4248	2	.9423	2	208.1	29	39.2	25	18.8	35
56	Aircraft and parts	.4160	3	.9474	1	291.2	23	31.5	30	10.8	47
83	Hotels	.3485	16	.7933	72	484.0	11	55.2	19	11.5	45
76	Wholesale and retail trade	.3983	8	.8317	70	3947.0	1	550.5	2	13.9	41
85	Other services	.3546	14	.7776	76	684.6	7	107.5	8	15.7	38
81	Health and education	.1606	69	.4288	85	129.0	41	34.4	28	26.7	24
82	Business services	.4038	6	.6216	84	435.7	14	11.4	45	2.6	72

Appendix J (continued)

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[1] Row 91, input-output tables.

[2] Ranking of Column 1.

[3] Row 91, input-output tables.

[4] Ranking of Column 3.

[5] Row 91, input-output tables.

[6] Ranking of Column 5.

[7] Column 3 x 10% of final demand.

[8] Ranking of Column 7.

[9] Column 7 divided by Column 5.

[10] Ranking of Column 9.

Source: Appendix I (derived from input-output tables).

DATE DUE

THESIS 1971 c.2.
C.2

Appleton, Peter Lang

Economic Influence of Canadian Agribusiness: A Systems Approach

DATE	ISSUED TO
Aug 20	M. Veeman
Nov 9	Pat Mo[illegible]
Dec 8.	L. Unterschultz
3/15/72	CAES Competition Rizvi
March 6/73	A. Van De[illegible]
9.4.73	DL McLACHLAN (for) mo. DEPT ECON U of Calgary
Aug. 22/73	[illegible]
06/02/75	J. Copeland
Sept. 10/75	[illegible]
26/09/75	J. Copeland
1/03/76.	[illegible]

FORM L1-1152W
WILLSON STATIONERS